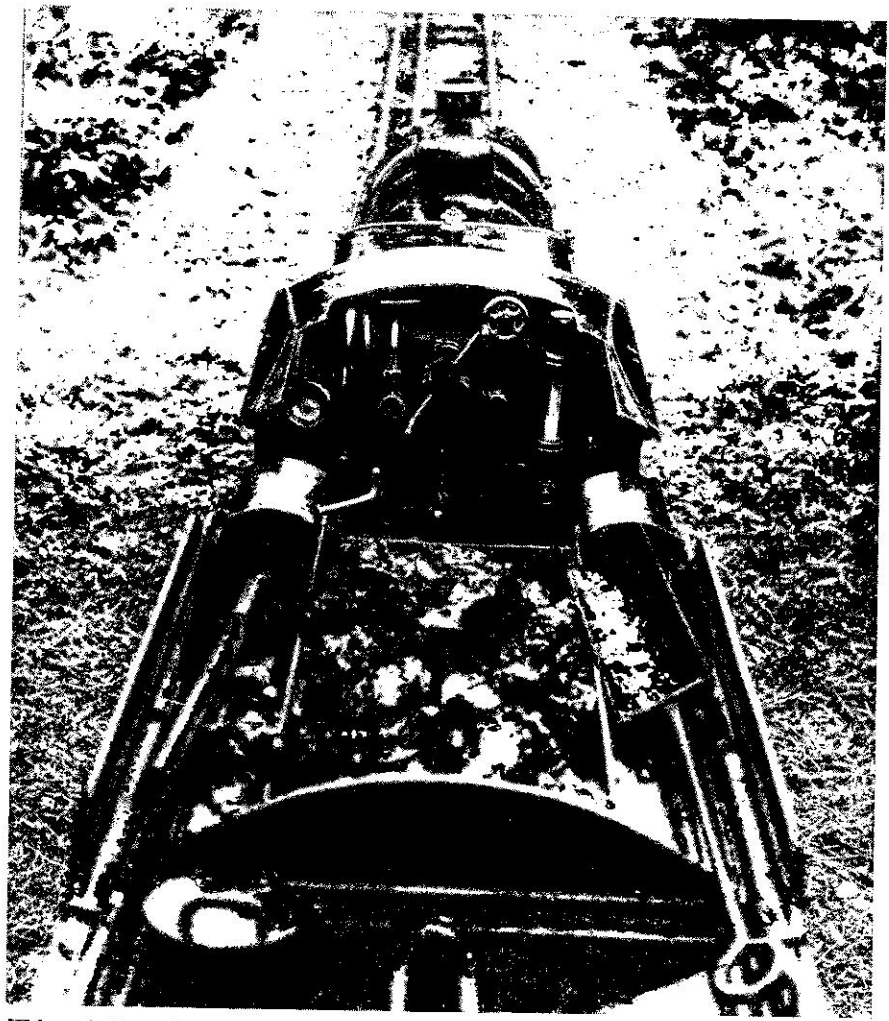
THE MODEL ENGINEER

Vol. 95 No. 2357 THURSDAY JULY 11 1946 6d



The driver's point of view—never to be despised! The engine is Mr. George R. Stevenson's 3½-in. gauge G.E.R. 4-6-0 "Wroxham Broad." The photograph was taken in mid-April, 3 p.m., on a Kodak P1200 plate with full-correction filter. Exposure 6 sec. at f 32

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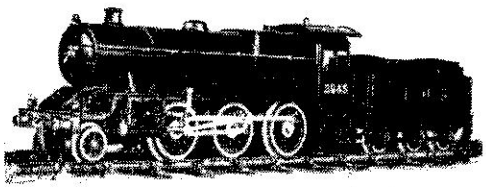

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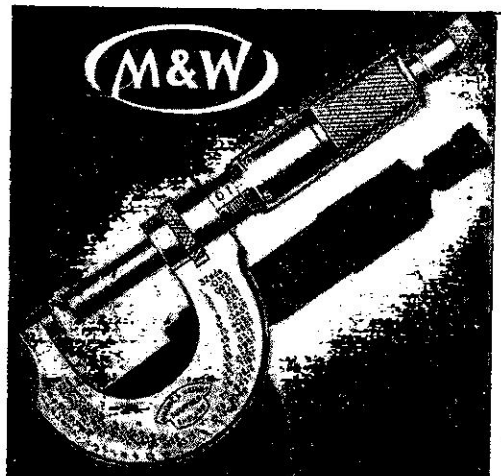

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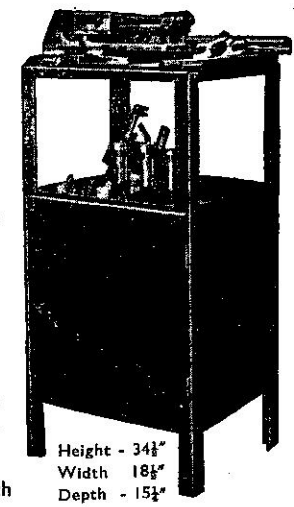

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THE MODEL ENGINEER

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VOL. 95. No. 2357. JULY 11th, 1946

Power-boating up North

I AM pleased to hear that Mr. T. R. Barnett, who has been Hon. Secretary and Treasurer of the Tynemouth Model Yacht Club for nine years, has been elected an honorary life member in recognition of his very efficient services which resulted in the membership being more than doubled. He has also been appointed an auditor, so he will retain an active interest in the club's welfare. Mr. Walker is the new Hon. Secretary. The North East Coast Power-boat Championship Meeting is to be held on July 20th, and a good muster of boats from the district is expected.

Screw Threads in Lathes and Machine Tools

NOW that we have had our interesting discussion on left-handed and right-handed human mechanics, may we consider for a few moments the effect of left-hand and right-hand threads as used in lathes and machine tools? I have in mind particularly screws which are used in slide-rests and tool-boxes for setting-in and withdrawing the cutting tool. I raise this point because when one is operating a lathe or machine tool for the first few times there is apt to be a little hesitation or even confusion of mind in deciding which way a handle should be turned to impart the desired movement to the tool. When we screw a bolt, or a plug, or even a wood-screw into its seating we automatically turn it clockwise to cause it to advance. The same movement is also applied naturally when we screw down a nut on its bolt. Clockwise motion is mentally associated with a forward movement. But if on a lathe slide-rest we turn the handle in a clockwise direction the tool is not moved forward, but is withdrawn. A moment's thought will reveal the reason—the screw is revolved, but cannot make any endwise movement. The nut, which is solid with the tool-post, therefore moves towards the operator and not away from him. In fact, the tool is withdrawn from its cut. This, of course, only applies when the screw has a right-handed thread. Most lathes are fitted with right-handed threads in the slide-rest, though, if my memory serves me well, I have met some with left-handed threads. The point I am making, however, is that the natural impulse to turn the handle in a clockwise direction to advance the tool must be discounted and the opposite motion applied. It becomes a matter of habit to do the right thing, though when changing over to a new lathe or machine tool this question of feed-handle rotation is worth a moment's study to ensure that the correct movement is made. A standardisation of threads for slide-rests and tool-posts would be a good thing.

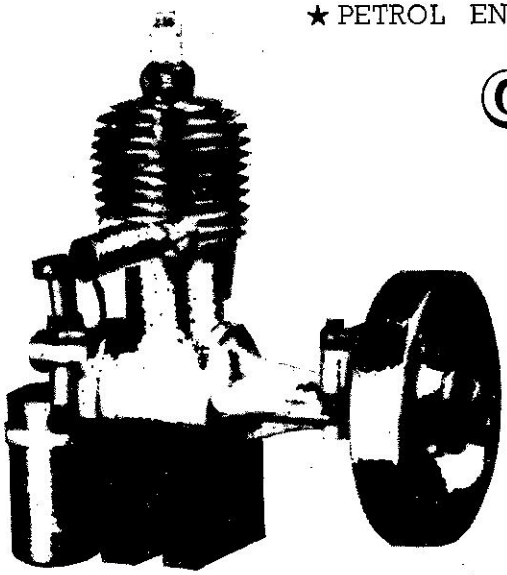
Model Engineering Supplies

I THINK a word about the short supply of some kinds of model engineering goods may not be out of season. This relates particularly to castings and raw materials which I understand are, in some directions, rather slow in coming through. A widespread post-war demand for materials for model making has arisen, and however anxious trade firms are to give good service they are sometimes defeated by conditions beyond their control. Just as the paper shortage embarrasses printers and publishers, so the scarcity of brass, copper, gunmetal, and of foundry labour handicaps traders in this field. I think that the trouble is not so much due to an actual shortage of metals as to the fact that so much of the available material is being absorbed in the drive for export trade and for the re-stocking of the home market. A little patience, however, should see the position right itself and bring about a more ample flow of model engineering supplies.

Just a Reminder

Do not forget that next Saturday, July 13th, is the last day for sending in entry forms for "MODEL ENGINEER" Exhibition Competition models. After that date will be too late!

Percival Marshall



CARVING OUT A 5-c.c. ENGINE

By EDGAR T. WESTBURY

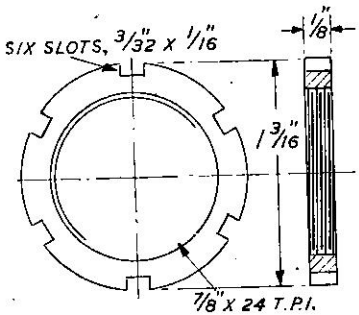
IT may be mentioned that there are two reasons why the rear endplate is not equipped with a flange, like that of the front housing. In the first place, it is most important that the endplate should be in the correct angular position when tightened up, and this is not easy to ensure, while at the same time preserving end location reasonably correct. The front housing has eight alternative positions, but only one point in the revolution is permissible in the case of the endplate, to bring the carburettor passage into its timed location immediately below the shaft centre line. Secondly, the means of mounting the engine involved the use of a plate or bell-ring clamped to the rear of the crankcase, and to use the endplate as the clamping member would further complicate both end location and timing. The use of a locking ring on the endplate has therefore been decided upon as the most convenient method of attaining the desired ends, but this feature is optional, and constructors who prefer to locate the endplate by shimming up, or careful machining of a flange joint, may do so.

Locking Ring

This is a straightforward turning and screw-cutting job; the material recommended being duralumin. The spanner slots may be produced by any convenient means—milling, shaping, or filing; a method which calls for the minimum equipment or trouble in setting up is to plane them out by means of a parting tool set sideways in the tool-post, indexing the lathe mandrel in six positions, and cutting to a set depth (as indicated by the cross-slide index), by racking the saddle backwards and forwards. Here again, a simple indexing device, using the lathe change-wheels, will prove very useful. The tool should be set exactly at the correct height, symmetrical with the lathe centres, and light cuts taken; a groove not less in depth than the slots should first be turned in the bar behind the ring, to provide chip clearance. The ring is finally parted off, leaving a slight allowance for skimming the back, which can be carried out by mounting it on the screwed mandrel which was used when working on the crankcase barrel.

Transfer Port Cover

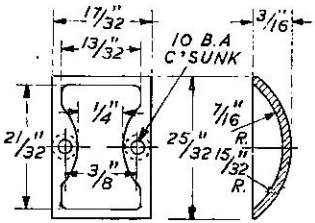
The best way to produce this is to hold a short piece of 1 in. diameter aluminium alloy bar in the chuck, face the end, and turn it to $\frac{15}{16}$ in. diameter for a sufficient length to part off at 17/32 in. from the end. Drill the centre to the same depth, and bore out to $\frac{9}{16}$ in. diameter, then use an internal recessing tool with a square or slightly radiused cutting face, to produce the centre recess, to a width of $\frac{1}{4}$ in., starting 9/64 in. from the front face, and 5/32 in. radial depth from the centre hole (this may be measured by the cross-slide index, as it will not be possible to get callipers in). The work is now parted off, allowing for cleaning up the back face, which should be done before cutting away the surplus material. It will be seen that the chord just touches the centre hole of $\frac{9}{16}$ in. diameter, and if a hacksaw is used, care should be taken to cut on the right side of the line to allow for truing up the flat face, which is best done by holding it in the four-jaw chuck and facing it in the lathe.



Rear housing locking ring

★ *Continued from page 626, "M.E.," Vol. 94, June 27, 1946.*

The cover is now in its finished shape both outside and inside, except that the recess must be widened at the top and bottom to correspond with the width of the cylinder ports. This was carried out in my own case by holding it in a small vice mounted on the vertical slide, and milling out with a round-nosed end mill, $\frac{3}{16}$ in. diameter. A certain amount of "fancy work" was necessary to circumnavigate the curved sides of the recess, around the fixing screws. The use



Transfer port cover

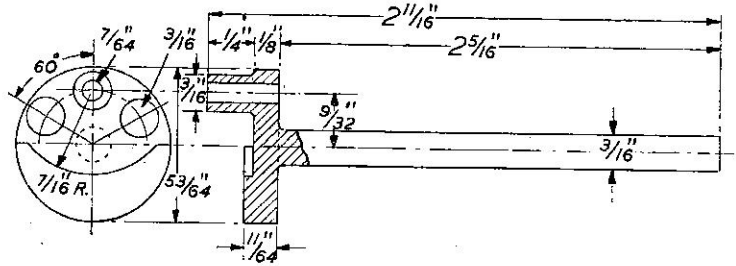
of a "stencil plate" to guide the cutter, as used in routing operations (this method was used by Mr. Chaddock in producing his rotary blower some years ago), would help matters, but it should be noted that the depth of the cut must also be varied, in addition to the face contour. The use of dental burrs, in a hand-piece driven by flexible shaft or other means, will be found helpful for finishing the recess.

The holes for the fixing screws are drilled to clear 10 B.A., and countersunk on the outside, after which the cover can be located on the port face of the body, and the tapping holes in the latter spotted off. Final finishing of the cover face is best accomplished by lapping on a piece of plate-glass, and if properly carried out, no packing material should be found necessary for making a perfectly tight joint.

The length of the main journal is perhaps a little abnormal in relation to its diameter. Some engine designers favour a larger diameter shaft of shorter length, but I have found that length is the most important factor in ensuring long bearing life, providing, of course, that the diameter is not cut down too small for structural strength. It will be seen that the end of the shaft is kept up to full diameter, and is not reduced by tapering or screwing; this is another "bee in my bonnet," which may not meet with universal approval. These details are, of course, at the option of the individual constructor, but I would point out that few of my engines have suffered from bent or broken crankshafts as a result of crash landings; whereas these mishaps are quite common in certain other types of engines, particularly those having a driving flat or square on the shaft—often with a very pronounced undercut behind it, which weakens the shaft at a critical point. The friction-mounted hub used on most of my engines adds a little weight, and calls for a propeller with a larger central hole than usual, but it forms a useful "safety valve" which protects the shaft against both bending and torsional impact.

One reason why the full disc crank web is used in this engine is to conserve crankcase clearance, but the more usual cutaway web may be used if desired, and will remove more metal from the crankpin side, enhancing the effect of the balance weight. But balancing troubles are not very serious in tiny engines, and I note that some commercial engines use only rudimentary balance weights, or none at all, apparently with complete success. The two $\frac{3}{16}$-in. holes drilled in the web, on each side of the crankpin, may be increased slightly in size by reaming, to adjust balance, if found desirable.

With regard to material, most constructors will probably have to make use of what is available, and I may mention that I have used a mild-steel



Crankshaft

Very similar shafts have been described in dealing with previous engines, and the further information given in my recent articles on methods of making crankshafts should make it unnecessary to go into details about this one. Its small size, however, involves the need for more than ordinary care in setting out and machining, and it is best to make it from a solid piece of $\frac{7}{8}$-in. steel bar, by the methods shown on page 285 of the March 21st issue. In my own case, I used the Keats vee angle-plate for holding the journal in the eccentric position for crankpin turning.

shaft quite successfully, both in the case-hardened and the soft state, in these engines, but in the latter case, the quality of the bearing material in which the shaft runs assumes great importance, and some of the harder bronzes will cut the soft steel badly. It has been found possible to case-harden the shaft without appreciable distortion, using the "open-hearth" preparations and methods usually available to the model engineer. If any kind of heat treatment is employed, however, the journal surfaces should be lapped afterwards to clean off any scale formed in the

operation, and allowance should be made for this in machining; about 0.0005 in. will suffice in most cases. Some kinds of steel appear to be much more prone to wastage by scaling than others, and the same thing applies in respect of distortion; one can only be guided by experience in these matters, learning to avoid the materials which prove troublesome in handling.

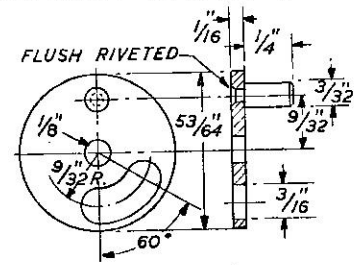
Rotary-valve Disc

This may be made either of mild steel or cast-iron, the latter being much the better in respect of wearing properties, though the load on the face is so light, and lubrication so effective, that very little wear need be anticipated in any case. A small disc like this may be machined and parted off from a piece of bar quicker than cutting from sheet metal. The working face should be machined, the edge turned, and the centre hole drilled, all at one setting, and after parting off, it can be re-set as truly as possible to clean up the other side.

It is most important that the hole for fitting the driving pin should be drilled at exactly the same radius as the crankpin, so that it cannot bind or transmit any radial thrust when working. The easiest way to ensure this is to make a simple jig from any odd disc of material, which is first drilled in the centre to take the crankshaft a close fit. By running a 7/64-in. drill through the hollow crankpin, the radial position may be "spotted" accurately, and the disc is then used to locate the position of the hole in the rotary valve, by clamping it to the latter with a screw shouldered down from $\frac{3}{16}$ in. to $\frac{1}{8}$ in. so that it fits the centre holes of both discs. A $\frac{1}{16}$-in. hole should be drilled through the disc, and countersunk on the face side. The driving pin is made from a piece of 3/32-in. mild steel, shouldered down to $\frac{1}{16}$ in. for a length of 3/32 in., and having a chamfer at the other end to provide "lead" and assist assembly. Rivet the pin in firmly and file any excess metal down flush with the disc.

Set out the position of the valve-port as shown on the drawing, which represents the valve as seen from the driving-pin side, and timed for anti-clockwise rotation of the shaft, with the carburettor port vertically below the shaft. If any modification, either in rotation or carburettor position, should be made, the angular position of the port should be altered accordingly. It is a simple matter to cut the port by drilling two pilot holes on the centre lines indicated, with a third hole bisecting the angle between them; then opening out the holes to $\frac{1}{16}$ in. diameter, and filing out to the shape shown. After removing burrs, the valve disc and its working seating on the endplate should be lapped on a sheet of plate-glass, as recommended for other components.

It may be mentioned that if the engine is intended to run at very high r.p.m., there is something to be gained by balancing the valve disc, the most convenient way of doing so being by leaving a raised rim which can be filed away as required so that the complete disc runs in static balance. This point is not of very great importance if the engine is used for the purpose of driving an airscrew, at a speed not exceeding five or six thousand r.p.m.; but in prolonged tests of a



Rotary valve

5 c.c. engine having a similar valve, I have noticed a tendency for the centre hole to wear oval, showing that the valve has tried to balance itself by assuming an eccentric position at high speed.

Variations in the timing of the rotary valve may be made by turning the rear endplate slightly, and locking it in place as required; but personally I have found this adjustment of very little value, as the valve timing is not at all critical, and very little effect on either starting or running was noticed in positions varying up to about 15 deg. in either direction from normal timing; but beyond this, the effect was detrimental in either case.

(To be continued)

For the Bookshelf

The Railways of Tottenham, by G. H. Lake (London: Greenlake Publications Ltd., 156, Camden High Street, N.W.1). Price, 8s. 6d. net.

It is probable that very few railway enthusiasts, outside the immediate area dealt with in this book, realise how much historical interest and importance are bound up in the development of the comparatively few miles of railways which pass through the Borough of Tottenham. One of London's most densely-populated suburbs at the present time, Tottenham is some six miles north-by-east of Liverpool Street station and is, therefore, primarily associated with the Great Eastern Railway. Mr. George H. Lake has obviously taken great pains in research, and has collected together a large amount of material which he has put into a most attractive form; his story grips the reader's interest at once and holds it throughout ninety-seven pages. The many photographic illustrations have been placed together on an art-paper inset in the middle of the book, while several diagrams and plans are well dispersed in the text. Essentially historical in character, this book is an example of which there should be many more; it is the work of a true railway enthusiast who possesses a rare knack of stimulating the enthusiasm of his readers. In these circumstances, the book can scarcely fail to achieve the success it deserves as an authentic record of an admittedly limited phase in railway history, but one that is well worth recording.

"MOTORISING" The Small Lathe

by H. H. Ward

NOW that fractional horse-power electric motors are appearing, even if slowly, upon the market, readers may be interested in the following methods of converting treadle lathes to power drive at low cost.

The Self-contained Unit

This method was applied to a 3-in. type "S" Portass lathe on treadle stand, which, in its power-driven form, did excellent work during the war in making gadgets for Civil Defence training and in maintaining the equipment of an important laboratory. It was a condition of this conversion that the drive should be completely self-contained so that the lathe could be moved at a moment's notice. The first step was to obtain a sound length of floor-board from which

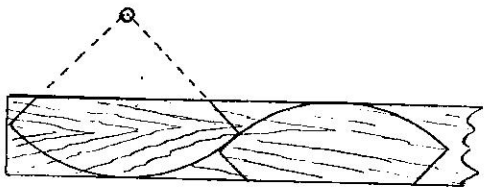


Fig. 1

to cut four segments of a circle, as shown in Fig. 1. When the joints had been planed to a good fit, the wood was secured to the treadle wheel by means of two $\frac{1}{4}$-in. Whit. countersunk screws tapped into the rim of the iron wheel in each piece, as shown in Fig. 2, and when thus assembled, formed a wheel approximately 1 in. larger than the top step of the treadle wheel. Although not shown in the sketch, the screw heads were bedded down on to $\frac{1}{4}$-in. washers, sunk into the wood to prevent the heads of the screws from pulling through. With the treadle re-erected, an assistant drove the wheel by foot-power whilst the writer turned a *deep sharp groove* for $\frac{5}{16}$-in. diameter round belt in the edge of the wooden wheel, and trued it up for the sake of appearance at the same time. The tee-rest, Fig. 3, for this job was improvised from a soap box and a metal plate, as seen in the third sketch, the box being held firm by the writer's foot being placed inside it. The motor, a $\frac{1}{4}$-h.p. repulsion-induction model of larger than usual dimensions, had now to be bolted on the underside of the chip tray so that its pulley would be linable with the new wooden pulley, but this was not possible, owing to the fact that the chip tray had a narrow neck to allow the belt to pass. The motor was therefore placed as near as possible, and had its shaft extended by the combined hollow shaft and pulley, seen in Fig. 4. It was feared that this long overhang might have a bad effect on the motor bearing, but in four years of fairly intensive use, no appreciable wear took place in the ball-race. The wiring of the motor was carried in conduit to the tailstock end of the stand, where, after passing through an iron-clad 15-amp. switch-fuse box, it passed via a heavy three-core flex to the power plug. The stand was, of course, "earthed" by means of the third wire.

The general layout of this drive is seen in sketch Fig. 5, where it is clear that the run of the belt is on the short, tight side. It was thought at first that the drive was going to be a failure, due to belt slip, but when the rawhide belt had finished stretching and had settled down, no further trouble was encountered. The treadle link was detached during power driving, but was retained *in situ*, as the treadle drive was handy on small screwcutting jobs for "running back" instead of de-clutching the lead screw. A minor alteration in the motor itself was to reverse the cover plate on the end so that the air intake holes came on the underside and so were not likely to have turnings dropping into them.

A Three-speed Gear Countershaft

Originally put in as a temporary measure to drive a $4\frac{1}{2}$-in. Britannia B.G.S.C. lathe until a more orthodox countershaft could be obtained, the drive about to be described, which makes use of a three-speed cycle hub, has been retained for a number of years because of its convenience, and shows no sign of wearing out. The lathe is situated in an outside shed and was moved slightly so that the headstock came in line with two framing members of the shed, one in the roof and the other on the wall. Two lengths of

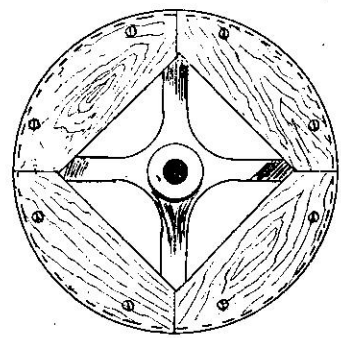


Fig. 2

bedstead angle-iron were secured across from the wall to the roof, as seen in sketch Fig. 6, and were packed out until there was just room between them for the cycle hub. The sprocket on the hub was unscrewed and a hardwood pulley having a bare $1\frac{3}{8}$-in. diameter hole was forced on to the screw and locked by a $1\frac{3}{8}$-in. × 26 t.p.i. locking washer of the type used with fixed-wheel sprockets. A series of wooden pulleys was then built up to the same ratio,

but slightly larger than the vee-speed cone of the lathe, and was secured by means of three nuts and bolts to the hub flange remote from the sprocket. These details, omitting those inside the hub, will be seen in sketch Fig. 7. After shortening the cable, the control lever was mounted on the angle-irons just above the headstock of the lathe. As Fig. 6 is almost self-explanatory, it only remains to mention the performance of the gear. It was found possible to change *up* by merely taking the cut off the lathe and making the change with the lathe running light. In changing *down*, however, the centrifugal force generated by the hub running at a higher speed than that for which it was designed, keeps the pawls in mesh so that the motor has to be stopped and the main belt pulled slightly to and fro by hand until the gear changes down. Theoretically, taking the back gear into account, the lathe has 3 × 3 × 2, or eighteen speeds in all, but some are virtually duplicated in practice.

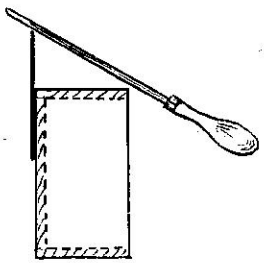


Fig. 3

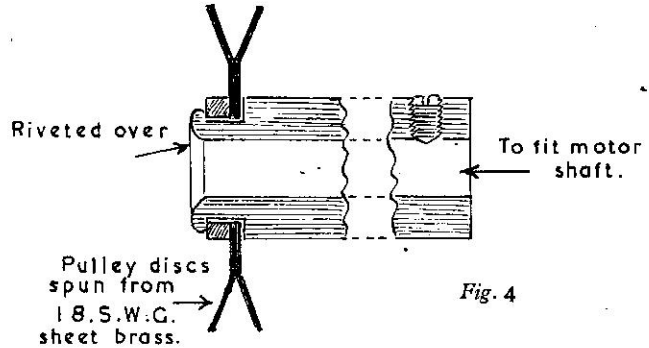


Fig. 4

A Countershaft for Confined Spaces

The writer lives in a town house where the only available place for use as a workshop is a washhouse, with a floor space 6 ft. 6 in. × 6 ft. As it contains a 4-in. B.G.S.C. lathe, drilling machine, bench, a twenty years' accumulation of tools, and the inevitable junk collected by the inveterate "gadgeteer," there is, to put it mildly, not a lot of surplus space. In fact, a facetious friend asked the writer if he found it necessary to go outside when he wished to turn something over in his mind! Over the lathe are two very useful shelves, and, when the question of motor driving the lathe arose, it looked as if it would be necessary to sacrifice the lower one in order to put the countershaft on the wall. By using the device about to be described, the shelf was retained, and only eight inches of its length were diverted from their original use. The countershaft itself is built up on a front hub of a bicycle, the model chosen being a "New Hudson" pattern which is fitted with thin lock-nuts inside the frame so that the ball-race adjustment is not affected by loosening the outer nuts. A piece of thin-walled steel tubing, 1⅛ in. o.d., was obtained, and a 1¼-in. washer was bored out to a tight fit on the tube. This washer was then silver-soldered 1 in. from the end of the tube and the tube was cut ¼ in. shorter than the length between the lock-nuts. The hub was then set up in the lathe and the spoke flanges

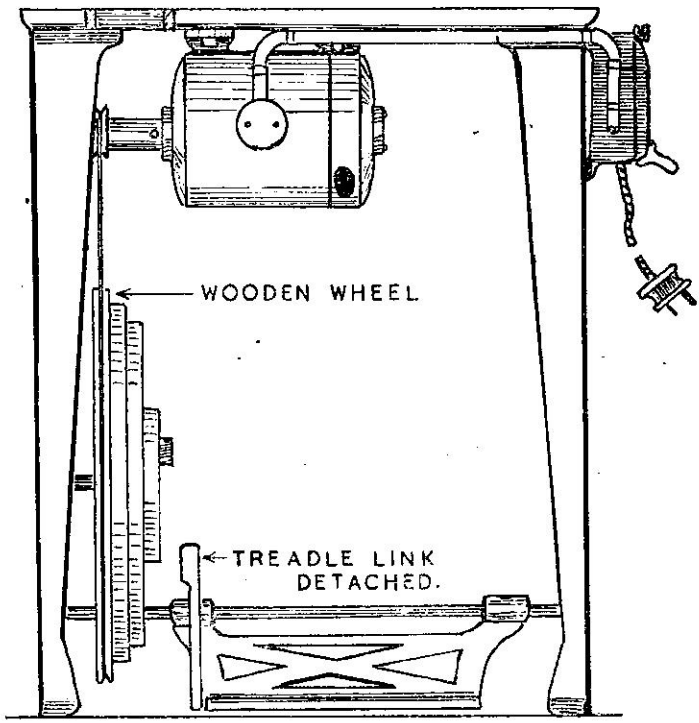


Fig. 5

were turned so that the hub could be driven tightly into the tube. Two hardwood (lignum vitae, in fact) pulleys, 8½ in. and 7½ in. diameter by ½ in. thick, were then turned to fit on the tube and were secured by screws tapped into the washer. The vees in these pulleys were again made both sharp and deep, to give a good grip on ¼-in. diameter leather belting. On the remainder of the tube, three flat belt pulleys for ⅝-in. wide belt were built up from odd scraps of 8-ply mahogany. The first of these was

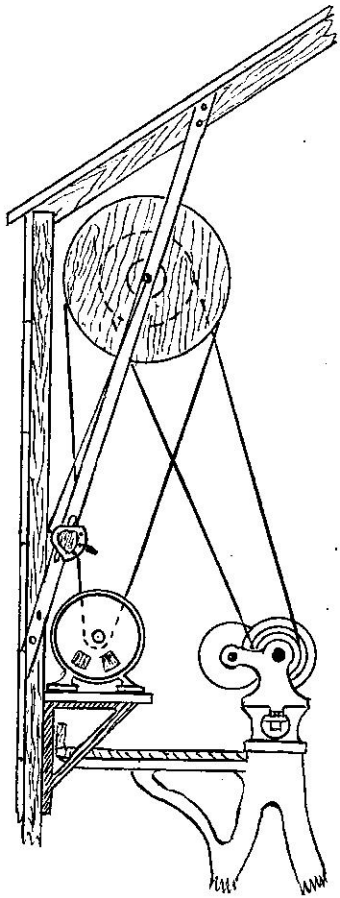


Fig. 6

secured to the large lignum pulley by means of screws passing through it, and each plywood pulley was secured to the next until the whole pulley assembly was made solid, as shown in Fig. 8. The shelf was then cut at the appropriate place, level with the lathe headstock, and two 3-in. × 2-in. battens were affixed to the wall so that the shelf could be supported firmly by two strong 10-in. × 8-in. steel-brackets. Two further lengths of 3-in. × 2-in. timber were then secured to the ends of the shelf, which was re-erected with a 4-in. gap to allow the belts to pass through. Two pieces of bedstead angle-iron were next sawn off as wide as the shelf and were slotted near the front end to take the hub spindle, whilst the other ends were secured together by a

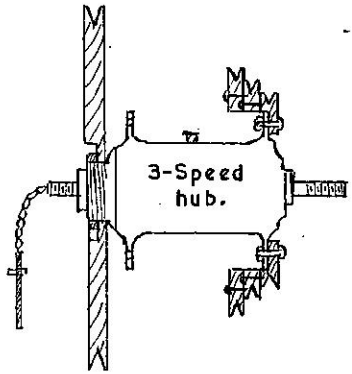


Fig. 7

bolt and a 4-in. long tubular spacer. These were screwed to the 3-in. × 2-in. pieces on the shelf and the countershaft was put in place. The motor was then secured to a bracketed shelf

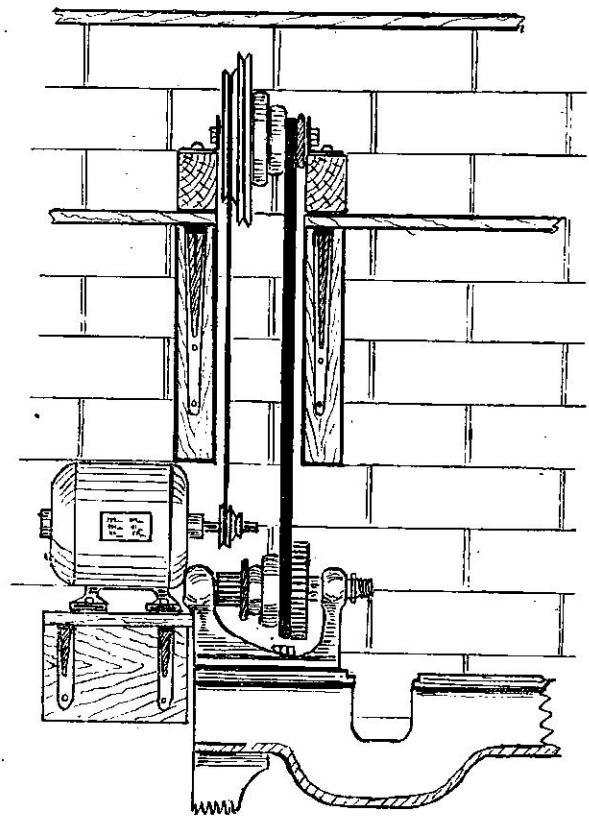


Fig. 9

behind the lathe, but in the general view, Fig. 9, the motor has been raised for clearness, as, in practice, the headstock almost hides it. The two-speed motor pulley is also of lignum vitae, and was turned *in situ* on the motor shaft until, by trial and error, the belt was equally tensioned on either pair of pulleys. It has been found that by raising or lowering one end of the hub in the slots, the flat belt can be made to ride exactly in the centre of the pulley, or by raising the hub bodily, a certain degree of belt tensioning is possible. This drive, including the back-gear, gives twelve speeds, which vary from approximately 60 r.p.m. to something over 1,000 r.p.m. As the lubricator is not available, the bearings are lubricated via the slots, using a pressure-type oil-can.

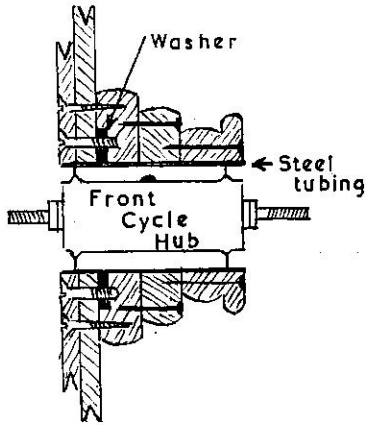
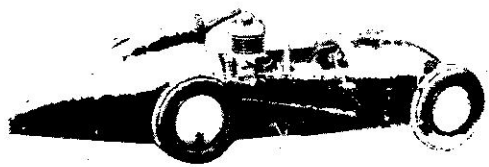


Fig. 8

The motors in each case had a speed of 1,425 r.p.m. In the self-contained unit the pulley ratios were, if memory serves correctly, 2 in. to 22 in., giving the treadle wheel a speed of 130 r.p.m. approximately. As a treadle usually runs at about 90-100 revs. per min., a slight, but in the case of a 3-in. lathe, useful increase in speed was obtained.

Model Racing Cars at Eaton Bray



THE British Model Car Club held its first open meeting at the Eaton Bray Model Sportsdrome on Whit-Sunday, at a new 72-ft. diameter cement track. Six cars were running, but considerable difficulty was experienced over engine starting. Many new cars were present, in various stages of completion, including one with an o.h.v. four-stroke engine under a hinged bonnet, one with chain drive, and a chassis with front wheel drive combined with independent front wheel suspension. More realism is apparent in the newer models, one of which resembled the modern racing Alfa, although the engine protruded from the cockpit, slightly spoiling the effect. One model had rear suspension by cantilever leaf springs, and front suspension by a transverse leaf spring and wish-bones, to give independent action.

The contests took the form of attacks on the mile record, the models being timed over 25 laps of the r.t.p. track, or for slightly over the full distance. Timing was by hand, but the Sportsdrome's electric tape timer was being used as a check. After the mile runs, cars were tried for the fastest lap of the day. Mr. Jones's beautiful model of a 2.9 litre Alfa-Romeo was the star performer. Its 10-c.c. engine started properly every time, and the first mile run was timed at 1 min. 16.4 sec., equal to 48 m.p.h. As the mixture improved, the Alfa speeded up, doing its last five laps at 55½ m.p.h. Later it covered the mile in 1 m. 11 s., equal to 52 m.p.h., and finally set the record at 1 m. 4.4 s., or 55.4 m.p.h. On its run for fastest lap it did 5 laps in 13.2 sec., equal to a lap speed of 57 m.p.h.

No one else could reach this speed. Mr. Middleton's f.w.d. car with 10-c.c. Hallam engine, gave a lot of trouble, but eventually covered the mile at 38.3 m.p.h., and averaged 36½ m.p.h. over 5 laps. Mr. Russell's enclosed-cockpit Auto-Union crashed and damaged the streamlined body, but running as a chassis, clocked 35.3 m.p.h. for the mile. The only other car to be timed was Mr. Steven's f.w.d. 5-c.c. Hallam-engined Special, which, running low in fuel, averaged under 30 m.p.h. for the mile.

Howard Boys produced a tiny rocket-propelled car, able to run equally well either way up. Its first run was very fast indeed, and, timed on a subsequent run, it clocked about 40 m.p.h.

The Sportsdrome hopes to hold meetings about once a month, and will build larger and better car tracks during the winter. And Howard Boys talks of using liquid fuel in a jet-propelled car before then.—W.B.

Progress in Full-Sized Locomotive Design

FROM much that one hears and reads from time to time, it would be easy for the non-technical reader to assimilate the idea that there has been no substantial progress in locomotive design and construction in this country since about 1890.

Actually, of course, nothing could be farther from the truth; there has been tremendous progress in the directions both of improved power for a given weight and improved economy in maintenance and running. This applies particularly to the period since the amalgamation in 1923 into the present four great railway companies. Taking the biggest of the companies, the L.M.S. had at the time of the amalgamation over 10,300 steam locomotives; by the end of 1945 these were reduced to just over 8,000.

The mileage covered by these individual locomotives each day, however, had increased by 30 per cent. and, in consequence, these 8,000 locomotives were piling up a greater total mileage than the 10,300 had previously done. Their average power was considerably greater, and due to more efficient methods of servicing and repair, they spent a much higher proportion of their life "available for duty."

All of us who knew them admired the old-time "Singles," and they were amongst the best engines of their day. Their work is, however, surpassed daily by 4-6-0 "mixed traffic" classes with driving wheels of 6 ft. 0 in. diameter or less, not only as regards loads hauled (as would be expected by all those people who understand the connection between adhesive weight and effective tractive effort), but as regards sheer speed. The L.M.S. 4-6-0 two-cyl. 6 ft. 0 in. class are consistently putting up speeds of 90 m.p.h. or slightly over, to name one class only, whilst there are very few authenticated records indeed, of even the best of the "Singles" with driving wheels from 7 ft. 6 in. to 8 ft. 0 in. diameter exceeding 90 m.p.h., and then only slightly for a short distance under favourable conditions.

The reason is not far to seek. Outwardly, the "front end" of a modern locomotive may not differ a great deal from that of an engine of 1900 vintage. Inwardly, it most emphatically does. The old "Singles" and their contemporaries had, according to modern ideas, comparatively small ports and steam passages, not too good exhaust arrangements and short-travel valves with leads which were large in proportion to their laps. In consequence, at speeds of 70 m.p.h. and over their drawbar pull began to disappear with great rapidity, and in the 80's most of their power was absorbed in moving themselves and getting rid of their exhaust steam. All this has been changed: G. Jackson Churchward in this country pioneered the modern trend, and Chapalon in France has carried it to its logical conclusion.

Modern locomotives, particularly the most successful, embody large steam supply pipes with easy bends, ample ports with short direct streamlined passages, and the freest possible exhaust arrangements. With these go long-travel valves with long laps, comparatively short leads and no exhaust clearance. The use of piston valves has become well nigh universal, and the tendency has been to increase the diameter of these relative to the pistons; for instance, the "Channel Packets" have 11 in. diameter piston valves for 18 in. bore cylinders, as compared with 8 in. bore piston valves for 20 in. bore cylinders with the original L.N.E.R. "Pacifics." Average steam pressures have been gradually rising during the last 40 years: 160-170-180-200-220-250, and now 280 lb. to the square inch.

Superheating has developed from tentative beginnings around 1905-7 to a practice which, for main line work, may be regarded as universal.

Mr. Bulleid, in his recent paper before the "Mechanicals" on the "Merchant Navy" class of locomotive made the following remark: "Provided the areas of the steam pipes and ports and the volume of the steam chests are such that the cylinders can be fed properly with steam with a minimum drop of pressure during admission, locomotives can do useful work at piston speeds as high as 2,000 ft. per min." (In the case of the "Merchant Navy" class this piston speed corresponds with a locomotive speed over the rails of 110 miles per hour).

It is probable that the best Singles ever built were to be found in either the G.W.R. "Achilles" and allied classes, "Connor's" 2-2-2 Caledonian engines (*before* they had their valve gear "improved" by having lap reduced and lead increased), Stirling's 2-2-2 7 ft. 7½ in. G.N. engines, or S. W. Johnson's penultimate Midland singles; these latter being my personal choice. I had the honour, as a young man, of meeting Mr. Johnson, after his retirement, and when I expressed my admiration for his "Princess of Wales" class (the last class of singles built by the old M.R.) he told me that he preferred the previous class, as he felt he had provided too much cylinder power for the available adhesion weight of the later class. Of their day and generation these were all good engines; but they are completely outclassed by modern express and mixed traffic engines. This is no discredit to their designers; it would be a very poor tale if considerable progress had *not* been made in 50 years, and it is certainly no compliment to men like Stroudley, Stirling and Johnson to suggest that such progress has not been made.

To take figures given officially by the L.M.S. people, their latest "Pacifics" show a fuel economy of 40 per cent. as compared with earlier heavy express locomotives, whilst they also quote the fact that, in fast running, their modern locomotives have an increase in power of from 10 to 30 per cent. compared with previous locomotives of similar weight.

In 1944, the 8,000-odd locomotives took care of 13,000,000,000 passenger miles and 10,500,000,000 freight ton miles.

These figures compare with 7,500,000,000 passenger miles, and 7,500,000,000 freight ton miles for 10,300 locomotives in 1923, and alone, amply refute any suggestion that progress in locomotive design and construction has been wanting in the last 25 years.

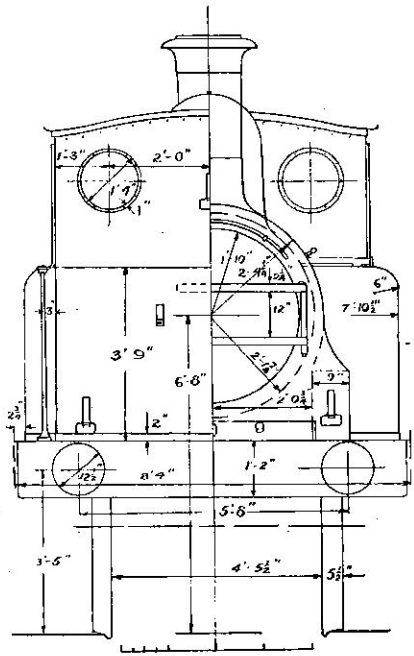
— K. N. HARRIS.

LOCOMOTIVES WORTH MODELLING

By F. C. HAMBLETON

No. 15—L.C.D.R. Railway No. 145

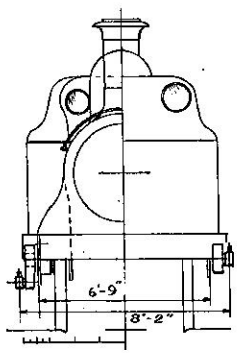
YEARS ago, the mere mention of the London, Chatham and Dover Railway was enough to provoke sarcastic smiles and remarks from those whose standards of speed and comfort were derived from the major British railway companies. But although much might have been wanting as regards passenger accommodation and such matters as punctuality and frequency of service, yet the locomotive stock in itself was both excellent and interesting. It comprised designs emanating from two very sound engineers: William Martley, and his successor, William Kirtley. The latter, a nephew of the celebrated Matthew Kirtley, had risen to high position on the Midland Railway at Derby, before leaving for the South to settle down in a London suburb and take charge of Longhedge Works at Battersea. Here he had a near neighbour in the person of William Adams, hard by at Nine Elms, and the two chiefs proceeded to turn out from their respective works real London-built locomotives second to none in finish and performance.



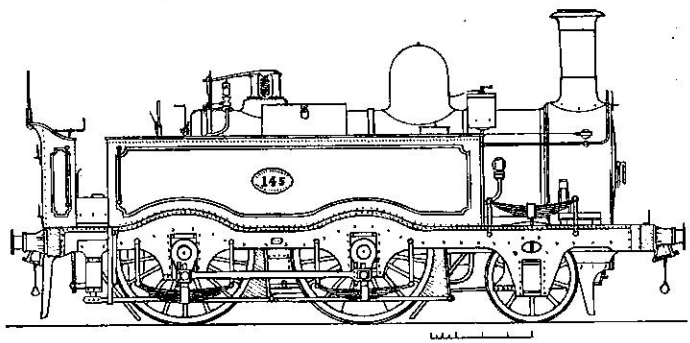
Shades of Victoria! There was something very "Chatham" about the position of the cab windows and the curiously end-curved roof

The first task that fell to the lot of the Longhedge engineer was to maintain and reboiler the earlier Martley engines—a job somewhat similar to the one that faced William Stroudley in his early days at Brighton. Standardisation was a thing unknown on either railway system, and although such a state of things was most interesting in the variety of types it presented to the gaze of the enthusiast, it must have often given these talented gentlemen some busy and anxious thoughts. Out of such a medley of types, half a dozen little side-tank engines commend themselves to the loco-modeller, partly on account of their trim appearance, and partly because they never ran with covered-in cabs, thus giving the "driver" of our miniature easy access to the various controls.

These old Martley locomotives (already converted by their designer from tender to tank engines) came in for boiler rebuilding in 1876 and the following year. Their original numbers, 65 to 70, were then altered to 145-150, and their names, *Onyx*, *Emerald*, *Diamond*, *Ruby*, *Amethyst*, and *Pearl* were not perpetuated. The new Kirtley boilers, of course, had the standard L.C.D.R. mountings; a nice dome, a Ramsbottom safety valve with polished brass columns and vermilion spring, the long brass blower valve, and an extremely handsome chimney. The firebox front at the footplate end was edged with brass, as were the spectacle plates, and a nice



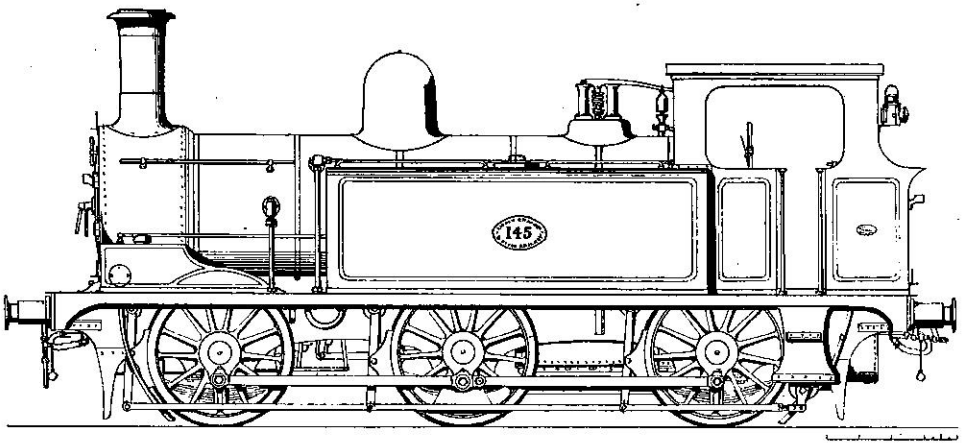
Interesting weatherboards and wing smoke box front plate



A charming combination of Martley and Kirtley was old 145. Note the sandbox

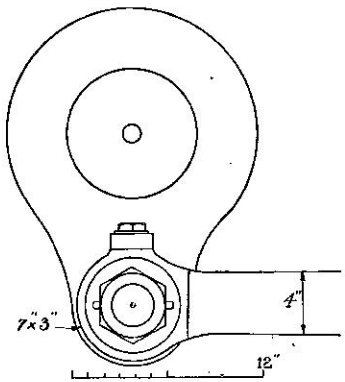
brass number-plate with black background adorned the tank side. Quaint touches were afforded by the handrail which circled over the top of the smokebox, and a rectangular sand box set up on high. The outside frames and cranks (both black, lined with fine red lines) were of pleasing shape, and the polished coupling-rods with adjustable cottered ends looked well against the background of underhung springs. How pretty these little engines were as they puffed along in their cheerful way! Quite old-world in one sense, and yet modern and up to date with their Kirtley touches. Black was their colour, relieved with a grey band which was bordered inside with a thin yellow line, and outside with a fine red line. The corners of this band were turned with a reversed quarter circle—a feature later changed on the "Chatham" to the more

Londoners in the Victoria and Herne Hill districts. There *always* seemed to be one or two shunting about the carriage sheds outside Victoria station; indeed, a visit to the famous old terminus hardly seemed complete without a glimpse of one or other of them! Like all the Kirtley designs, one can fairly term them the orthodox locomotive, thoroughly typical of British practice in the early 'nineties. They had round-topped tanks, and a nice comfy cab, and were distinguished by a pleasing neatness of outline. When the amalgamation with the S.E.R. took place their charming black livery gave place to a rather over-ornate colour scheme, but, worst of all, they lost their most elegant chimneys, which were replaced by short nondescript things of Ashford design. These two changes had a most drastic effect on their general appearance. At once they



Side elevation showing the neat and trim outline of the second No. 145

usual curved angle. The vermilion buffer-beams carried big gold numerals which were shaded black, the buffer sockets were black, as was the border to the beam itself. The headlamps were painted red—a rare colour in those days—and the two headboards most commonly in use were the plain white, and the white with two horizontal black bars. These little engines ran until 1890-91, when they were replaced by 0-6-0 tank engines of Kirtley's design. Thus a new No. 145 made her appearance in 1891, class "T" (the older engines were known as class "R"). The numbers of the newcomers ran from 141 to 150, and so good was the material put into them at Longhedge Works, that one or two of them are with us even today. There was never a nicer-looking shunting engine than the new No. 145, and the "T" class quickly became familiar to



Typical solid-eyed coupling-rod end as fitted to the second No. 145

became squat, over-wide, fat little engines, and gone for ever were the good looks of the L.C.D.R. regime. What a pity! Yet in fairness one must remember that much the same was probably said when Kirtley replaced the heterogeneous collection of copper-capped Martley funnels by his own finely-drawn one. All a matter of taste, you remark. Yes, true, but it is curious that some engines (for example the L.N.W. *Stephenson* class single-wheelers) looked equally well with either Ramsbottom or Webb chimneys, whereas we all remember what happened to *Gladstone*, when her Stroudley masterpiece was replaced by the parallel-sided Marsh monstrosity!

And so, good loco-modeller, if you feel inclined to model the 1891 No. 145, put on the original Kirtley chimney, please. I could give you a

(*Continued on page 42*)

From SCRAP *By Peter*

MODELS from scrap or the junk box from which many readers have found the material to construct a working model, has been the subject in many editions of THE MODEL ENGINEER. I, therefore, humbly beg to contribute this article, which I hope may be of interest to some. The meaning of scrap as applied to model engineering is difficult to define; however, take it for what it is worth. I submit a free-lance design of a single-cylinder low pressure vertical engine. The accompanying photographs clearly show the type, and I hope the following description will explain the material and how it was used.

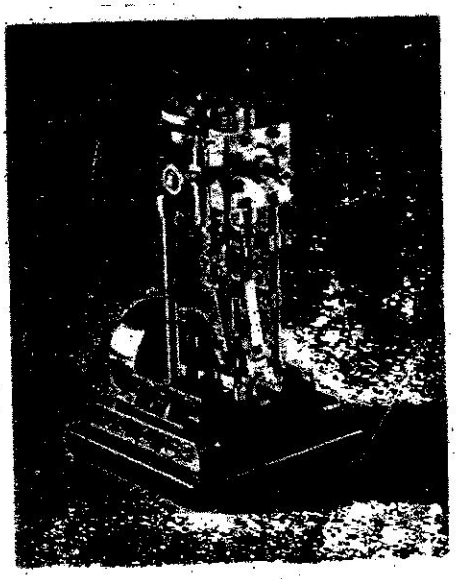
"Machining" the Cylinder

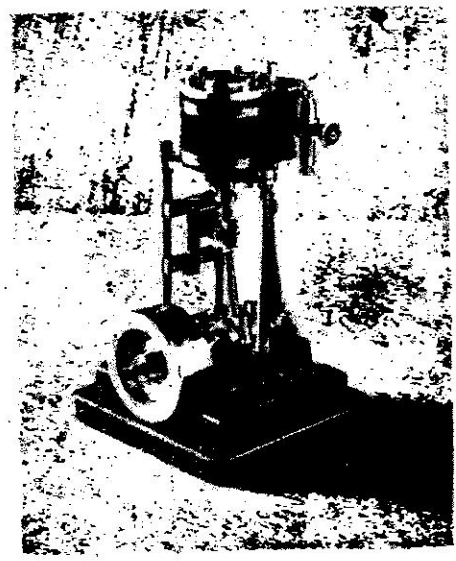
The cylinder was first, and was made from a short end of round duralumin bar. This was attacked with hacksaw and file and roughed out to the approximate shape; then the bore, outside wall and port face were marked out, chucked in the four-jaw, bored, and the end faced. Common practice was then followed, with face plate, angle plate and balance weight. The block was bolted faced side down on the angle plate and the surface of the port face machined. Next a mandrel was turned from a piece of aluminium bar on which was mounted the block in order to face the other end. This accomplished, the mandrel had a few grooves turned therein and was used as a lap; attention was then directed to the covers. The top one was turned from a piece of the same duralumin bar, leaving a 1/32-in. spigot. The bottom one was made from a piece of aluminium scrap—I think it started life as a timing-case cover. This was chucked, faced on one side and spigot turned, hole drilled and reamed for piston-rod, reversed, faced and turned to leave the stuffing box which was drilled and tapped. This cover was then marked-out, sawn and filed to shape, both top and bottom covers were drilled tapping size *in situ*, the holes in the cylinder being tapped 8 B.A. cover holes, then opened out for clearance. The studs were made from 14-gauge cycle spoke (very tough, this material, won't twist off). The block was now filed to shape, leaving the covers to overlap the diameter by about 3/64 in. to receive the wood lagging, which was made from narrow strips of mahogany, these being fastened with two brass bands cut from an old bearing shim and four No. 12 B.A. screws. Steam and exhaust ports and ways were drilled and cut in the usual manner but with no pretence that the engine should be efficient under steam. The steam-chest and steam-chest cover were made from pieces of the aforesaid timing case, faced in the four-jaw, marked out, drilled to remove metal from the centre, filed up and chucked again to machine the stuffing-box and guide end, drilled *in situ* and fastened to port face with 8 B.A. studs and nuts (screws never look realistic). The D-type slide valve was made from a piece of ¼-in. sheet brass, two flats being filed on the valve spindle to actuate same.

The Base

The base I can hardly claim as scrap, although it was made from a scrap piston. A wooden

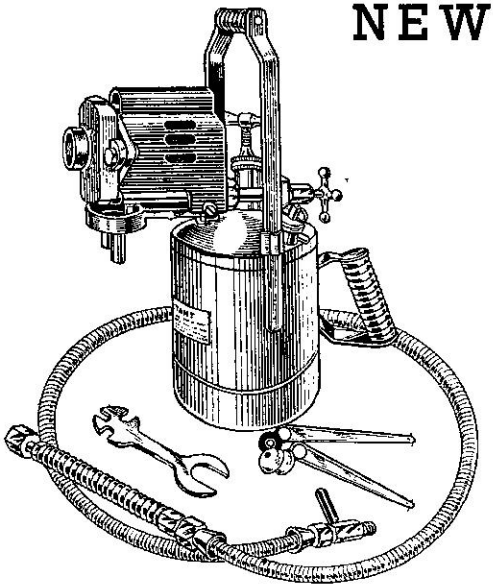
(*Continued on page* 38)





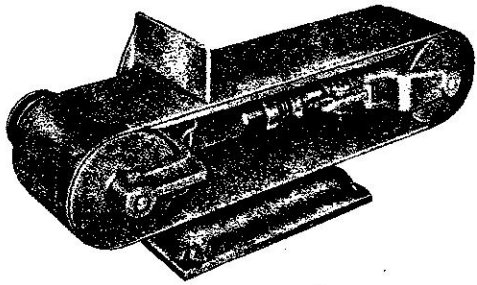
Two views of the model free-lance single-cylinder low pressure vertical engine made from scrap material

NEW BARGAINS AT GAMAGES



Five-pint blowlamp with 4-ft. flexible extension pipe

IN pre-war days, the Motor Accessories and Tools departments of Messrs. A. W. Gamage Ltd., Holborn, London, E.C.1, were always a centre of attraction for model engineers, and despite the difficulties in obtaining supplies of any kind during the war, there has always been something of interest to be seen there. With the gradual improvement in supply conditions, every effort is being made to restore and replenish



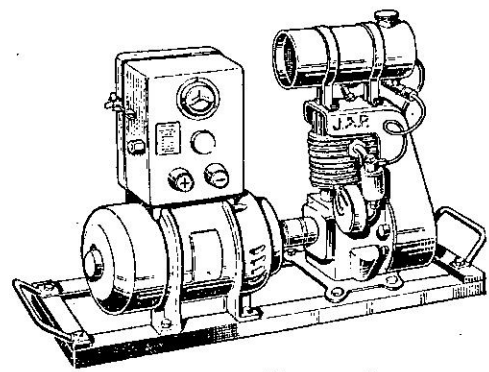
4 in. belt sanding machine

stocks of new and second-hand tools and equipment, and surplus goods in wide variety. A recent visit to this department brought to light a number of interesting new items, some of which have already been announced in our advertisement columns.

Among workshop equipment, the 6-in. circular-saw benches deserve special mention. These are constructed from aluminium castings, and are fitted with a tilting table for angular cutting, and a rising and falling saw spindle to adjust the depth of cut up to a maximum of 1¾ in. The size of the table is 14 in. by 10 in., and it is equipped with a straight fence for parallel cutting and a sliding adjustable fence for cutting angles, mitres, etc., also a swinging saw guard. Another useful power tool is a 4-in. belt sander or "linisher," having a belt 4 in. wide and a work-table 12 in. long, with a back-stop 2 in. high, adjustable for angle. The spindles run in self-lubricating "Oilite" bushes, and adjustments for both tension and tracking are provided. One abrasive belt is supplied with the machine.

The second-hand portable steel benches, as recently advertised in THE MODEL ENGINEER, are useful for garages or home workshops. They are built on a framework of angle steel, 1½ in. × 1½ in. × ⅛ in. section, with diagonal struts, and a heavy steel table, 3 ft. long by 2 ft. wide, turned up to form a rim at the back and sides. Two 6-in. wheels are provided on the bench legs to facilitate shifting.

The surplus goods include portable lighting and charging plants, comprising 1 h.p. J.A.P. air-cooled governed engines, direct coupled to either 12-volt or 32-volt dynamos, with instrument panel equipped with ammeter, variable field



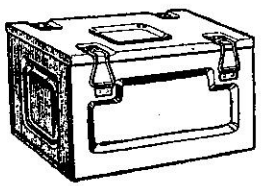
The 300-watt portable generating set

resistance fuse and cut-out. These sets are mounted on angle steel frames, with carrying handles, and weigh 90 lb. They are suitable for continuous work, the fuel tank having a capacity of one quart, sufficient for three hours' running, and may be used either for battery charging or direct connection to lighting or power circuits.

An item of surplus equipment which will appeal to many model engineers is the heavy-duty five-pint British-made blowlamp illustrated herewith. A special feature of this lamp is the detachable burner head, which can either be used in its normal position on the top of the container, or connected to the flexible metallic pressure tube (4 ft. long) and used in a remote position, the pump and control valve being permanently attached to the container. Fittings include burner spanner, nipple cleaners and spare pump-cup leathers. At the price of 22s. 6d.

quoted for this item, it represents remarkably good value for money, and will fill a long-felt want for such purposes as boiler brazing and other work requiring intense heat.

Another surplus item which will be found useful in the workshop is the pressed-steel tool-box illustrated. This is of extremely heavy construction, weighing 33 lb., dimensions 27 in. × 17 in. × 10 in., and fitted with flush inset handles and lever fasteners; it represents excellent value at 12s. 6d. Boxes, cabinets and bins for workshop use, in steel, are also available, and very strong, well-finished hardwood cases, 15½ in. × 11½ in. × 7¾ in. inside dimensions, with iron-bound corners, strong hinges and fasteners, originally made for battery boxes, but highly suitable for tools and instruments, are offered at 5s. each.



Metal tool chest

In the Motor Accessories department, there are, apart from the many items of interest purely to motorists, many lines which will appeal to the model engineer and experimenter. Brand-new 180-deg. twin magnetos at 32s. 6d., other single- and multi-cylinder magnetos, coils and distributors, electrical equipment, carburation and fuel-line accessories, are shown in a wide variety. Some of the surplus goods are worth buying for breaking down into their component parts; as for instance, the battery-charging cut-outs (ex-aircraft) at 3s. 6d. each, which comprise an electro-magnet or solenoid, suitable for use in an electric clock, point motor, or relay, three pairs of tungsten-tipped contacts, a fixed resistance, and a two-piece bakelite case. The number and variety of these lines are constantly being augmented, and readers who have occasion or opportunity to visit Holborn will find it well worth while to call at Gamages.

From Scrap

(*Continued from page* 36)

pattern, webbed and true to type was made; this was moulded and cast in piston alloy and cleaned up. The heavy housings were next filed; no miller or shaper being available, holes for the stanchions were drilled from the bottom cylinder cover. The eccentric sheave was machined from a ½-in. M.S. bolt end, the strap from ⅛-in. M.S. plate bolted with two 10 B.A. bolts and nuts, lined with 0.005 brass and riveted for the rod which was filed from 1/16-in. M.S. sheet.

The piston—just another piece of ¼ in. brass plate, sawn out and turned, with one groove packed with graphited cotton. All rods, spindles, stanchions, etc., were from scrap ends of M.S. rod, glands, etc., from ends of brass rod. The main bearings are split half brasses of square section, shouldered to prevent movement in housing, retained by a steel keep and four 10 B.A. studs and nuts and fitted with a brass cup lubrication.

The Crankshaft

The crankshaft was built up in the usual manner, the webs being cut out with balance weights, from the end of a 1 in. diameter bolt—from my early recollections, however, this type of launch engine, which was much in evidence fifty years ago, did not have a balanced crank.

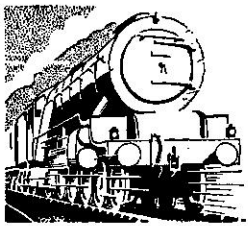
A correctly shaped connecting-rod was cut out and machined from a 5/16-in. bolt, and fitted with split brasses at the bottom end. The crosshead was from ¼-in. M.S. plate, filed away to allow two half brasses to be housed on the underside and fastened with two 10 B.A. studs and nuts, this forming the bearing for the shouldered wrist-pin. A brass sole-plate is bolted at the back of the crosshead with two 10 B.A. bolts and works in the guide bars. Both guide bars and guide bar supports are from 1/16-in. sheet steel. The ply was turned from a short end of 2-in. cast stick, which gave a bit of trouble on a 1⅝-in. Adept lathe. This lathe was, with the exception of a small sensitive drill, the only machine used in the whole construction.

The Built-up Lubricator

A small displacement lubricator was built up and added, the base cellulosed green; all metal parts have a high degree of finish and appear more realistic in these metals than in brass. I would say that the model (?) looks well, and runs on 3-4 lb. of air.

The principal dimensions are: 7/8 in. bore, ¾ in. stroke, 5⅜ in. height excluding wooden stand, 3½ in. length, 2¾ in. width, 1 3/32 in. length of cylinder, 1⅜ in. diameter of covers, 1 3/32 in. × 1⅛ in. × 5/16 in. steam chest, ⅛ in. thick chest cover, ⅜ in. crankshaft, 1¾ in. × ⅝ in. flywheel.

Thanks are due to my friends, Mr. Hallam for pouring the molten metal to form the base, and Mr. Crosby for the photographs.



"HIELAN' LASSIE"

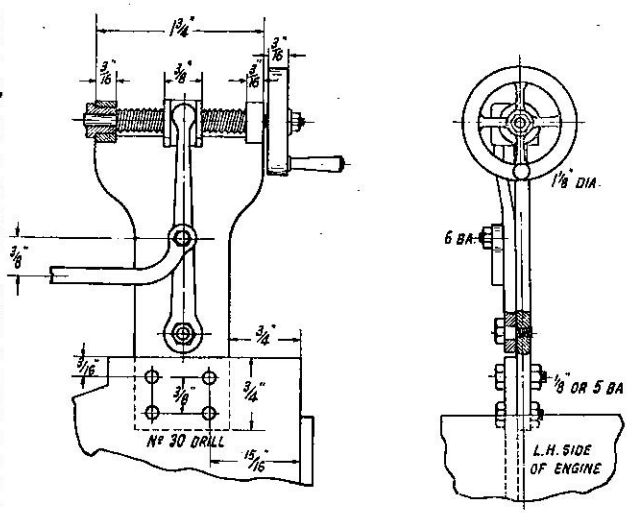
By "L.B.S.C."

ON the full-sized L.N.E.R. Gresley Pacifics, the driver's reversing-gear consists of a vertical screw operated by a handle like a tender brake handle, up close to the boiler backhead; this is connected to the horizontal reach-rod by a bell crank. On a little engine, this arrangement is about the worst possible for a driver who has to reach over from a position behind the tender; I've had some, as "Tishy" originally had the vertical and inaccessible reverser, and after fumbling about with it for two or three runs, burning my fingers on the backhead, and not being able to see the position of the nut, I jolly soon altered it to an ordinary horizontal wheel and screw. Since then, there has been no trouble, and so I decided to specify a similar gadget for the "Lassie." However, on doing a bit of visualising, one or two little difficulties became apparent, as usual. One was, that the horizontal centre-lines of a reverser in the cab, and the reach rod below the running-board, were so far apart that the reach rod would have needed a wide radius bend to enable it to be connected direct to the reversing nut. Such a bend would have been unstable, altering in radius, both by pressure of the reversing screw, and the pull-and-thrust of the valve gears when the engine was working hard. On top of that, and accentuating the above trouble, the top of the reversing arm on the weighshaft of the outside cylinders only needs to move $\frac{7}{16}$ in. for complete reversal of the engine, owing to the difference in length between it and the lifting arms. This would have meant an extremely short screw; and apart from increasing the bending strain on an already unstable reach rod, would not have allowed a fine adjustment of the cut-off when notching up on a continuous run.

Well, difficulties were made to be overcome, and we got over this lot in a simple manner, by using a reverser something like the one specified for "Petrolea"; but instead of using a double-armed lever, a single-armed one was substituted, so that the engine goes the same way that the lever is inclined. The screw was made long enough to allow for 1 in. traverse of the nut, and the end of the reach rod was connected to the lever at a point which moved $\frac{7}{16}$ in. from extreme back to forward. As this point was only $\frac{3}{8}$ in. above the centre-line of the reach rod, the bend was too small to have any tendency to alter its radius either way. The whole doings is shown in the general arrangement sketch reproduced here; so now to construction.

Stand and Bearings

The stand may either be a casting with the bearings cast on, or it may be built up. If a casting is used, clean up with a file, and centre-pop the two bearings. Put a $\frac{1}{8}$-in. drill through both, and see that it lines up with the top edge of the stand, both vertically and horizontally. If it doesn't, correct with a rat-tail file, and try with a little larger drill. When O.K., open out one bearing to $\frac{5}{16}$ in., and the other to 9/32 in., tapping this $\frac{5}{16}$ in. by 40. If the stand is to be built up, cut out a piece of $\frac{1}{8}$-in. bright steel plate to the given dimensions. Turn up the two bearings from a bit of $\frac{7}{16}$-in. bronze or gunmetal rod—kiddy's practice job—and mill, plane or file a groove in each, so that they will fit tightly at each end of the top edge of the stand; then silver-solder them in position. Turn up a little nipple from a bit of $\frac{3}{8}$-in. hexagon bronze or gunmetal rod, by exactly the same process as described for cylinder glands, drilling it 5/32 in., and screwing the outside $\frac{5}{16}$ in. by 40. At 1 in.



Wheel-and-screw reverser

from the bottom, on the centre line, drill a No. 40 hole and tap it either $\frac{1}{8}$ in. or 5-B.A. for the fulcrum pin.

Screw and Nut

The reversing screws on most full-sized engines are left-handed; that is, you turn the wheel clockwise to put her in forward gear, just as you turn the handle of your lathe cross-slide clockwise to advance the tool into cut. Therefore, if you have a ¼-in. Whitworth tap and die with left-hand threads, you may as well use them for the screw and nut; but if not, use the ordinary right-hand tap and die. Chuck a bit of ¼-in. round mild steel in the three-jaw, and turn down ¼ in. of it to a nice running fit, without shake, in the screwed nipple of the front bearing; use the nipple itself for a gauge. Now pull the steel out of the chuck, exposing about 1¼ in. of it beyond the shoulder of the little journal just turned, and carefully screw it ¼-in. Whitworth, left-hand if possible, with the die in tailstock holder. Use plenty of cutting oil, and work the mandrel back and forth by pulling the lathe belt by hand. A good clean thread is essential. Pull the steel out a bit more, and part off 2 3/16 in. from the extreme end. Reverse in chuck; you can hold by the threads, if the chuck is not tightened excessively, to machine the other end. I have made dozens of reversing screws and never damaged a thread yet. Turn down 9/16 in. length to 3/16 in. diameter, a proper running fit in the back bearing; then turn down 5/32 in. of the end to 3/32 in. diameter, and screw it 3/32 in. or 7-B.A. Set the screw back in the chuck until 3/16 in. of the plain part behind the small thread projects from the chuck jaws; file that bit ¼-in. square, using one of the chuck jaws as guide, as I have described several times in previous notes. The length of the screwed part should be 1⅛ in., and should fit nicely between the bearings on the stand.

To make the nut, chuck a bit of ½-in. square bronze or gunmetal rod in the four-jaw (doesn't matter about it being exactly true) face the end, and part off a ⅜-in. length. On one end of this, make a centre-pop 9/16 in. from two adjacent sides (see illustration), then rechuck with this mark running truly. Centre, drill 9/64 in. or No. 12, and tap to suit the screw. At the bottom, plane, mill or file a groove a shade over ⅛ in. wide, just enough to let the nut slide along the top of the stand. In the side opposite to the tapped hole, form a groove ¼ in. wide and ⅛ in. deep; this could be done by end-milling, as described for the axleboxes and other milling jobs, or by a cutter on an arbor between centres, holding the nut in a machine-vice on the saddle. Failing any other means, a file will make a good job of it if properly handled—in more senses than one!

To assemble, put the nut in the middle of the stand; if the plain bearing is to your right, the recess in the side of the nut should face you. Put the screw through the tapped bearing, squared end first; screw it through the nut, push the end through the plain bearing, and screw in the nipple. When the nipple is right home, the screw should turn freely, without any end-play, moving the nut easily up and down the stand. File a shade off the screwed end of the nipple if the screw is stiff between bearings.

The wheel may be a casting ("Bantam Cock" reverser wheel casting will do, it is exactly the same) or it may be cut from a 5/16-in. slice of 1⅛-in. diameter rod. Dural makes nice wheels; I made a dural one for "Jeanie Deans." The spokes were formed by drilling four 7/32-in. holes and opening them out triangular shape with an "Abrafile," leaving four spokes which were rounded off with a strip of Aloxite cloth, the result being neat and pleasing. A 1/16-in. hole was drilled in the rim for the handle, which was turned from a bit of ⅛-in. nickel-bronze rod, with a pip on the end a tight drive fit for the 1/16-in. hole. The wheel was chucked in the three-jaw, centred, and drilled ⅛ in., the hole was squared by driving a punch through it. The punch is simply a 2-in. length of ⅛-in. square silver-steel, squared off truly at one end, hardened, and tempered to dark yellow. The other end is bevelled off, so that it doesn't become burred with hammer blows, and can be driven clean through the hole in the wheel boss. I have a small round block of cast iron (piece of the boss of a chuckplate casting that was too long) with holes of various sizes in it; wheels are laid on this for punching, over a hole of appropriate size to suit wheel boss and punch. The finished wheel is pushed on to the squared end of the reversing screw, and secured with an ordinary commercial nut.

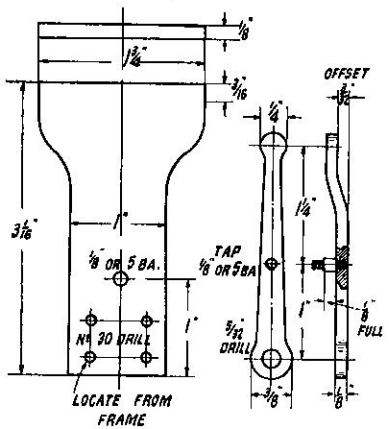
Lever and Reach-rod

The lever is milled or filed up from a piece of ⅜-in. by ⅛-in. mild-steel about 2⅝ in. long, to the shape and dimensions shown. The upper end should be a nice fit in the groove in the nut, and is offset 3/32 in. The lower end is drilled 5/32 in. for the fulcrum pin. At 1 in. from this hole, drill another No. 40 and tap it ⅛ in. or 5-B.A., for the reach-rod pin. To make this, chuck a piece of ⅛-in. silver-steel in three-jaw, and put ⅛ in. of thread on the end to match the tapped hole in the lever. Part off about ⅜ in. from the end, reverse in chuck, and turn down ⅛ in. of the other end to 7/64 in. full diameter, screwing it 6-B.A. Screw this tightly into the hole in the lever, and file off flush at the back. There should be just enough plain part projecting, to allow a 6-B.A. nut to screw tight up to the shoulder without gripping the boss of the reach rod. For the fulcrum pin, chuck a bit of 5/16-in. hexagon steel rod in the three-jaw, and turn down a full ⅛ in. to an exact running fit in the hole in the bottom of the lever; then further reduce ⅛ in. length to ⅛ in. diameter, and screw ⅛ in. or 5-B.A. to match the tapped hole in the stand. Part off to leave a head about ⅛ in. thick; reverse in chuck, and chamfer the corners. When the fulcrum pin is right home, it should hold the lever close to the stand, but not interfere with its back and forth movement, so the plain part wants to be exactly ⅛ in. long. My way of doing this is not to measure it, but slip a ⅛-in. washer over the plain part, and then, when turning the end for the screw, run the knife tool right up to the washer, and follow with the die. The plain part will then be exactly the correct length. To assemble, simply put the offset head in the groove in the nut, and screw the fulcrum pin home. When the hand-wheel is rotated, the lever should move back and forth easily, yet keeping in close contact with the stand. Don't forget a spot of oil!

Erection is simple. Drill four No. 30 holes in the left-hand side of the trailing cradle, as

indicated in the illustration; then place the stand in position $\frac{3}{4}$ in. from the back (it will just touch the rear angles of a built-up cradle) and $\frac{3}{4}$ in. below the top. Hold in position temporarily with a toolmaker's cramp, run the No. 30 drill through the stand, using the holes in the cradle plate as guides, and put in $\frac{1}{8}$-in. or 5-B.A. bolts, as shown in the end view of the complete assembly.

To save milling a long length of steel rod, the reach rod can be made from a piece of $\frac{1}{8}$-in. by



Stand and lever

$\frac{3}{16}$-in. rectangular steel about 16$\frac{1}{2}$ in. long, with a small block of $\frac{1}{4}$-in. by $\frac{5}{16}$-in. rod brazed on at one end to form the fork or clevis, and a boss at the other for attaching to the lever. This is a simple job needing no detailing out; I have already described several times how to braze these small jobs, and the milling and rounding-off of the fork jaws is done same as those in the valve gear, or the knuckle of the coupling-rods. The boss is merely a $\frac{1}{4}$-in. slice of steel, parted off a piece of $\frac{5}{16}$-in. round rod held in the three-jaw; the hole is reamed $\frac{1}{8}$ in.

The nominal length of the rod is 16$\frac{13}{16}$ in. between centres of holes, as shown in the illustration; but in case of any slight slip-up in making and erecting the valve-gear and reverser, take your measurement from the actual job. Put the reverser in mid-position, that is with the nut in the middle of the screw, and the lever vertical. Set the valve gear in mid-position also, with the die-blocks exactly in the centres of the links. Then measure the distance from the centre of the hole in the reverse arm on the weigh-shaft, to the centre of the pin in the lever on the reversing gear; this will give the exact dimension required. For connecting the fork to the reverse-arm on the weigh-shaft, use a bolt made from $\frac{1}{8}$-in. silver-steel, turned down to 3/32 in. at each end and furnished with small nuts, same as the top of combination lever and other parts of the gear; the boss end is merely slipped over the pin in the lever, and secured with an ordinary commercial nut. When the reversing wheel is operated, all three valve gears should respond, working evenly, smoothly, and in unison; there should be no tight places anywhere, and reversing should be equally easy in any position of the cranks. It always makes me smile when trying the reversing on a new engine, to recall an incident at my old home at Norbury, when somebody who reckoned he was the "cat's whiskers" at locomotive building, brought an engine to test on my road. She had a pole lever, and the only way you could horse it over, was to take a good grip and joggle the engine back and forth until something began to move! On the up-and-down road, it meant dismounting from the car at each end of the line—and yet this particular party turned up his nose at the simple loose eccentric!

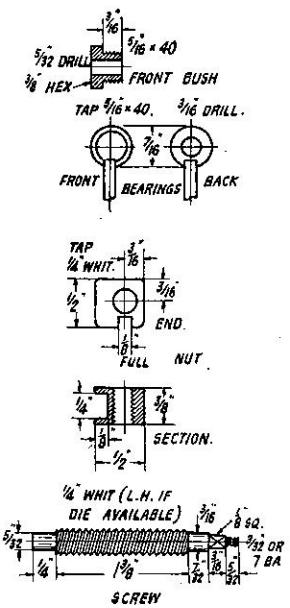
That finishes the Walschaerts gear (thank goodness, says me!) and as promised, I will, all being well, give the Baker-plus-two-to-one alternative; meanwhile, a word to our beginner friends. Take your time over the job and see you get every part right before any assembling and erecting is done, otherwise you'll be like one of my old munition girls—

There was a young lady named Brenda;
She hurried wherever you'd senda.
Till, alas! sad to tell
Near the stove, down she fell
And she got a black eye on the fenda.

—with this difference, that Brenda's eye, with a little careful nursing, cured itself, but a defective valve-gear won't; in fact it will, as granny used to say, get "wusser 'n' wusser." Therefore have it right to start with, and you will be well repaid by the smooth working, power and efficiency of your version of the "Lassie."

A Naïve Question

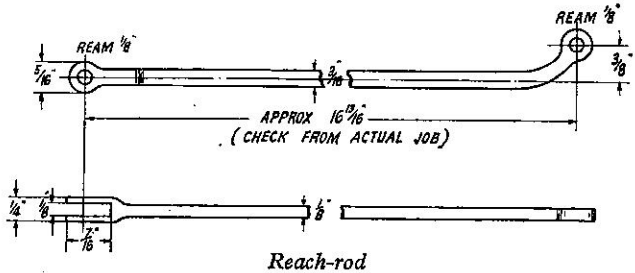
Some of our new readers have been emulating Tommy Handley's famous character, and asking,



Reverser details

"What *is* a Live Steamer?" Well, strictly speaking, the term is a generic one, as any engine

—stationary, locomotive, or marine—which takes steam direct from the boiler, can truthfully be described as a "live steam" engine. However, there are "Live Steamers" which are all that, and others which are not so live; in fact, some of them are as dead as ditchwater. But like sundry other "catch" terms, the nickname of "Live Steamer" has come to be taken generally to apply to locomotives built to specifications set out in these columns; and unfair advantage has been taken of this in some cases. How the term originated, was simple enough. Way back in the summer of 1924, when I was first invited to tell all locomotive enthusiasts how to build engines that would haul loads of living passengers, there was a little confab in the old MODEL ENGINEER offices at Farringdon Street, to decide what would be a suitable title for my series. The "conspirators assembled" were Mr. Marshall, the late Mr. Runciman, and your humble servant, and the final decision for the title was "Shops, Shed and Road: a Column of Live Steam." I wrote under that heading right up till the journal went "black-and-white" at the beginning of 1939, when the distinctive heading was abolished. Many locomotives were described under the heading, from the Gauge "1" "Ford Pacific" right down to the three-cylinder L.M.S. "5XP" "Olympiade," and they well and truly earned the title of genuine "Live Steamers."



Reach-rod

It was also suggested by some of the followers of the notes, that an unofficial "Brotherhood of Live Steamers" should be formed, in contradistinction to the numerous "Model Engineering" clubs; but although a start was actually made, at that time conditions of membership prevented it spreading. Anybody who pays his entrance fee and subscription can join a model engineering club; the Brotherhood wanted no money, but membership was limited to those who actually owned or were building a locomotive as described in my notes, or who was a driver or fireman on a full-sized engine. Responses came in all right, but prospective qualified brothers were so scattered all over the country that it would have been impossible to hold meetings, and the project fell through. However, I am delighted to know that some organisations specialise in locomotives, such as the "Merseyside Live Steamers" (grand title that), the "West Riding Small Locomotive Society" (sounds good, as well) and two or three "Amateur Engineering Associations," which certainly have a definite dignity.

However, over the big pond they did the job properly. Carl Purinton, Marblehead, Mass., promptly offered to act as Secretary to the American Brotherhood of Live Steamers, which caught on, flourished exceedingly, and is now the leading organisation of its kind in the U.S.A. and Canada, holding all-day meets at its big home track, attended by brothers from all over the vast continent. They have any amount of locomotives, both running and building, in which the principles as set forth in your humble servant's twenty-one years of instructions, are incorporated, so they can be truthfully called genuine "Live Steamers." I think the above explanation will satisfy the "Naives" of the locomotive fraternity; if they should, for instance, see a spirit-fired child's toy described as a "live steamer," even though the description is perfectly legitimate, they won't fall into the error of associating it with the real honest-to-goodness "Live Steamers" which have been illustrated and described in the "Live Steam" notes written by your humble servant.

Locomotives Worth Modelling

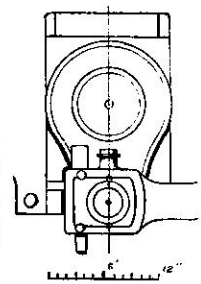
(*Continued from page* 35)

drawing of the later Ashford thing, but I'm not a-going to!

Useful Dimensions

"R" Class

Cylinders, 15 by 22 in. Wheels, 5 ft. 6 in. and 3 ft. 6 in. Wheelbase, 6 ft. 6 in., and 7 ft. 0 in. Boiler, 9 ft. 9¼ in. by 4 ft. 0½ in. diameter. Boiler centre line, 6 ft. 2 in. Length of firebox casing, 4 ft. 1⅝ in. Depth of inside firebox below centre line, 4 ft. 6 in.



"T" Class

Cylinders, 17 by 24 in. Wheels, 4 ft. 6 in. Wheelbase, 7 ft. 4 in., and 7 ft. 8 in. Boiler barrel, 10 ft. long by 4 ft. 0½ in. diameter. Centre line of boiler, 6 ft. 8 in. Height of bunker, 3 ft. 9 in. Height of cab roof (inside), 7 ft. 0 in. Leading overhang, 5 ft. 0 in. Trailing overhang, 5 ft. 9 in. Chimney, 3 ft. 6 in. height. Chimney above rail, 12 ft. 6¼ in. Dome cover, 2 ft. 6 in. high by 2 ft. 2 in. diameter.

The outside crank of No. 145, *was painted black, edged with a fine red line as was the axle too*

C. Baker gives us some

NOTES ON GARDEN RAILWAYS

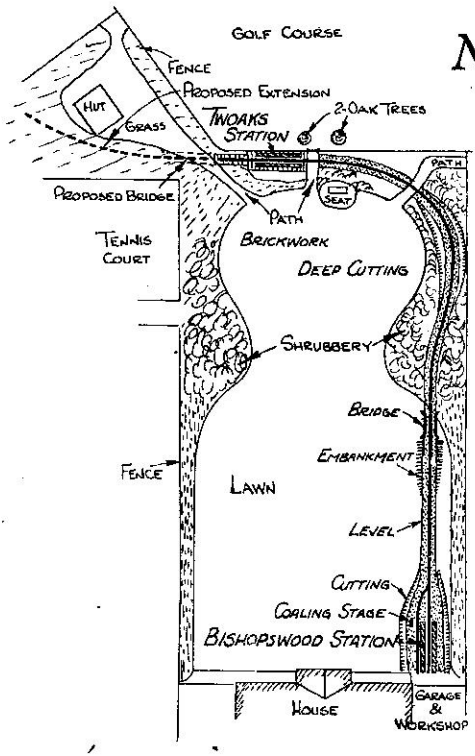


Fig. 1. Bishopswood and Twoaks railway—a layout in a large garden

INCREASING hopes of a gradual return to normal conditions have led to more interest being taken in permanent outdoor railways, and it is felt that a few notes on their construction may be helpful to those taking up model civil engineering for the first time.

Layouts fall broadly into two types, the elevated track, supported on trestles, and railways built at ground level. No attempt will be made to suggest which is the better of the two; that would raise so much controversy that the correspondence columns of THE MODEL ENGINEER would monopolise the entire journal for the next six weeks! But since elevated layouts, on which the driver and passengers ride astride the track, are usually of wood construction and realism is not attempted, these notes will be confined to ground-level lines, which follow real practice more closely and certainly look better.

A careful survey of the garden should be made first, to decide the best route. If new rolling stock is to be provided, a little thought might well be given to the gauge to be adopted. In most small gardens, where scenic effects are paramount, "O"-gauge will be found the most suitable for getting a reasonable amount into a small space; but, if passenger carrying is the criterion, quite large gauges are worth considering. A line laid to 5-in. gauge can be fitted into the same area as a 3½-in. gauge line, and with curves of almost equal radii if the favoured "Pacific" prototypes give way to small tank engines which are equally interesting, simpler to build and provide better riding qualities for passengers.

The relative importance of the railway, compared with the rest of the garden, must also be decided. It can be the principal feature, to which the horticultural aspect is subordinated; it can take a minor place in an obscure corner where it will not offend the eye of the orthodox gardener, or it can be made naturally to form a part of the general scheme, which is, perhaps, the most desirable arrangement.

Then comes the question of size. The actual length of running track should be as long as possible, but it can be augmented by sidings and made to represent a whole main line, with stations, signal-boxes, and all the other ancillaries, or it can consist of a single line of "straight." In the writer's opinion, it is best to start with a simple layout and complete it rather than to attempt an elaborate railway which becomes a wearying, and sometimes, unfinished task.

Two railways have been chosen to illustrate the points under discussion—the 300 ft. of the "Bishopswood and Twoaks Railway," a 3½-in. gauge line, with stations, embankments, cuttings, and a bridge, formerly owned by Mr. S. C. Pritchard, at East Finchley, and the writer's

Fig. 2. Bishopswood station

2½-in. gauge "Rockery Railway," a little under one-tenth of that length, and devoid of any stations. But the two have one thing in common, they both form a natural part of their gardens, as Figs. 1 and 3 show.

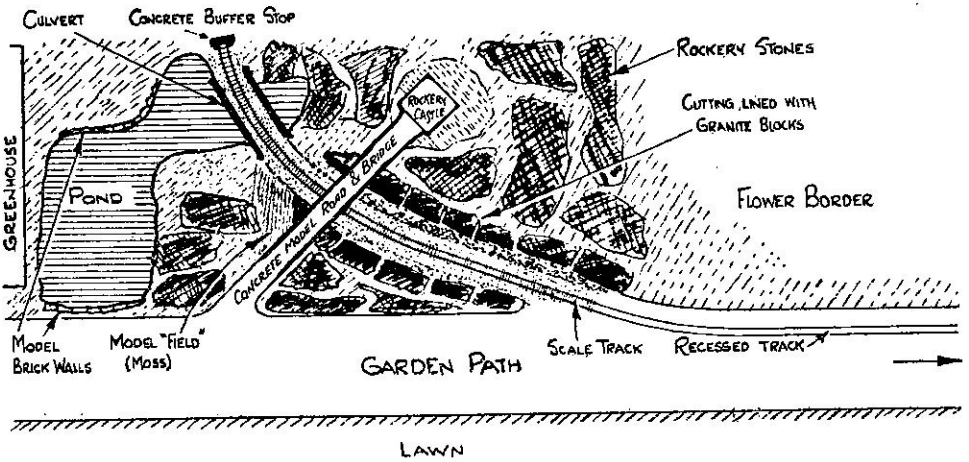


Fig. 3. "Rockery Railway"—a small garden layout

The existing level of the ground is, perhaps, the most important factor in deciding the route, although proximity to the "running shed," the general garden landscape, and such-like details, must also be taken into account. It is unnecessary to have dead level ground. Slight undulations create interest by needing cuttings and embankments. In the case of the Bishopswood Railway, the line started from the principal station in a cutting 6 in. deep. Level ground was struck 25 ft. along the line, but at 100 ft. from the station end an embankment, culminating with a short bridge, became necessary. The line then dived into a protruding flower bed and continued at a 1-in-50 gradient for the remainder of the way. The minimum-curve radius was 60 ft., but neither this nor the gradient had a detrimental effect on locomotive performance. The length of track, from end to end, was 300 ft., and the platforms at Bishopswood were 20 ft. long, they were made of concrete, 6 in. thick, and edged with wood. If scale-thickness edging is adopted, wood is more suitable than concrete, which is liable to chip off in service. All-wood platforms are, of course, quite satisfactory, particularly if they are of hard wood, well creosoted. It is advisable to use narrow planks (say 1 in. wide), screwed to cross strips, allowing a small gap between each plank rather than to make them of a single board, which is much more prone to warping. Twoaks station was timber-built on made-up ground enclosed in brickwork; this was necessary, since the garden fell away sharply as the station was approached.

Fig. 4. Preparing the reinforcing steel and mould shuttering for concrete bridges

A station on a garden railway is primarily an ornamental refinement, and, on purely scenic lines, may be provided with miniature concrete buildings, metal lamps, wooden seats and the like. But all such details should be omitted from passenger-carrying railways. For these, bare platforms should be provided each side of the track so that a raised surface an inch or so above rail level really helps the driver and passengers to board and alight, particularly on 3½-in. and

Fig. 5. A scene on Rockery Railway

5-in. gauge layouts. It is surprising what an inch or so means in these gauges. A driver seated on a flat wagon at underframe height has difficulty in manipulating the engine controls, but if the seat is raised a few inches, and stirrups provided which clear the platform face by about an inch, he can handle the regulator comfortably, and even the tricky job of firing can be done without moving from the driver's seat.

Station and lineside buildings are easily made of wood, but the general tendency is to err on the side of lightness. How different the buildings look after two winters! They demand a fair amount of work and energy to make them, which can often be better spent in preparing wood moulds for concrete models which really are permanent. Most moulds can, of course, be made in about two pieces, with a fair draft so that the parts can be withdrawn easily; but, for jobs of which only one or two are required, it is easier to build up the mould from a number of wooden frames and cores screwed to each other. These can be readily taken apart without risk of cracking the concrete. It should be remembered that quick-drying cements are often slow-hardening, and although it is a good plan to remove the casting before it is quite hard (say after about 15 hours) in order to smooth it off while still partly soft, there is a risk of breaking off the excrescences, and care is necessary in dismantling the mould.

Bridges are popular features, and concrete is an ideal material for both the under-line and over-line variety. The "Rockery Railway" provides two examples. The line is level and falls into two parts—a recessed track laid in the path, and a scale portion laid through a rockery; this passes under a bridge carrying a model concrete road, 8 in. wide, from the garden path to the "castle" in the centre of the rockery and continues over a bridge or culvert spanning the "backwater" of a small goldfish pond. The railway is very simple and does not boast even a single point, but it is long enough for test running, and the rockery portion, planted with miniature conifer hedges and moss "fields," looks very pleasing in summer. Granite and Bath stone are used for the rockery and simply rest on the soil. The fishpond follows usual gardening methods; but the other "civil engineering" features call for comment. The foundations for the castle, bridges and track-bed are through the subsoil on to a bed of well knocked-down aggregate. Anything less than 4 in. thick is liable to cause subsequent cracking. Bridges, of course, cannot be of consistent thickness and retain scale proportions, but if the retaining walls and base are strong and well reinforced, the bridge part itself can be pared down; it must be remembered, however, that thin concrete will not carry tension stresses, and adequate steel mesh, well bedded into the abutments, is necessary. The construction of the "Rockery" over-line bridge is shown in Fig. 4, and the shuttering for the sides of the culvert can be seen in the distance. The over-line bridge was cast *in situ*, and the culvert was built on a semi-circular roofing tile cemented at each end to the concrete abutments. In both cases, the parapets were cast as part of the main structure. A mixture of three of sand to one of cement was used, without the addition of shingle or gravel. A coarse mixture is difficult to work into small moulds and may prevent a good continuity of mixture between the steel reinforcing. Furthermore, a fairly wet mixture is recommended, which is not as strong as a drier mixture with the correct water content, but is far easier to tamp down into the corners of intricate moulds. For paths, miniature roads, foundations and other rough work, a coarse aggregate and no excess of water are better. The scenic effect of the two bridges in question can be judged from Fig. 5, and it is interesting to note that, after five years, they have shown no signs of cracking.

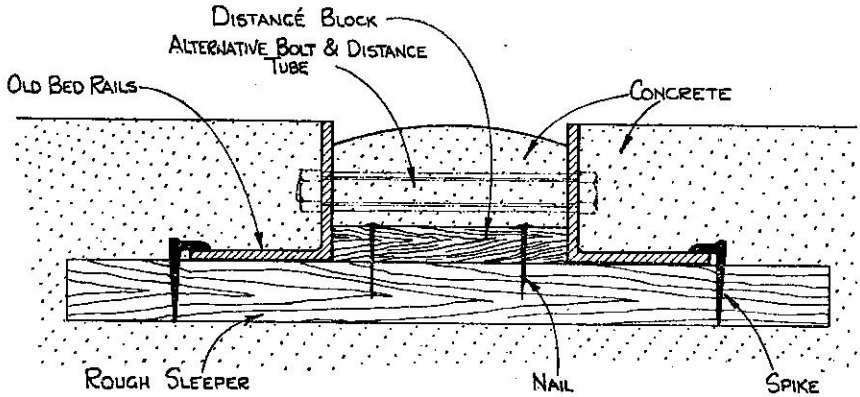


Fig. 6. "Tramway type" track recessed in a concrete path

Before leaving the subject of bridges, wood construction must be mentioned. Provided there is sufficient depth in the longitudinal members to prevent undue deflection under bending loads, wooden bridges prove very serviceable, particularly if they are removable during the winter months when the line is not in use.

For short lengths of track, lines at concrete bridges or other places where good foundations or real permanence are required, a 3-in. concrete bed, faced with 1 in. of cement and sand into which the sleepers can be pressed, is recom-

mended. After careful levelling and alignment of the track (this was completed in Fig. 4), the wet cement should be sprinkled with ballast (seen in the foreground) and further loose ballast applied when the cement has set. The sleepers of the "Rockery" line are oak strips, ½ in. wide by 1 in. deep, and well creosoted. If available, teak is really better, and does not require protective treatment to stand the weather. The rails are commercial bull-head brass fitted in white-metal slide-on chairs.

For long stretches of line a concrete bed is unnecessary. It is, however, inclined to cause noisy running as well as being rather harsh for passenger-hauling lines. A part of the "Bishopswood" Railway was laid on shingle, resting on shingle ballast distributed over set concrete. It was found somewhat difficult to align and to possess no special advantages; so the remainder of the line was laid on a 3-in. clinker bed. The track itself consisted of Vignoles-section brass rail, spiked to sleepers 9 in. long × 1 in. wide × 1½ in. deep; this out-of-scale depth did not show after the track was ballasted. It was made up in 9-ft. lengths, with the sleepers mounted on 1-in. by ¼-in. battens which were reasonably flexible. The arrangement proved very satisfactory indeed; it was soft to ride on and very quiet. Aligning, both vertically and horizontally, was an easy matter, since all that was required was to lift the track, straighten as necessary, and pack the sleepers with ballast, as in real practice. The 9-ft. lengths were very firm when ballasted and they could be lifted only with considerable exertion.

Simple tracks with no pretence at model accuracy often supply a special need and are cheap to construct. The "tramway-type" portion of the "Rockery" line is a simple example. It is laid with old bed-rails obtained from a scrap-merchant; they are approximately 1½ in. × 1½ in. × ⅛ in. steel angle, and about 6 ft. long, with the cast-iron end fittings sawn off. They are laid with their flanges outwards and are let flush into the path with the outer rail 5 in. from one edge; this allows ample clearance between pedestrians on the main part of the path and passing trains. A typical section through the track, showing the method of construction, appears in Fig. 6. After removing the subsoil, concrete mixed with a relatively coarse aggregate was laid down and levelled to approximately 2 in. depth. Rough wood sleepers at about 2-ft. pitch were bedded in the concrete, and the rails secured to them with spikes and wood distance-pieces. Experience over a number of years' service has shown that there is a tendency for the rails to open out, and a few tie-bolts through distance-tubes placed between the rails would have been an advantage; these are shown in the figure. A dressing of finer mixture was filled in to rail level and the contour between the rails finished off with a special tamping board. Where it ran along the narrow face of the rails it soon began to wear, and so affect the profile; but this was corrected by screwing on odd pieces of steel to make a wearing surface.

A few feet at the end of the "tramway track" are curved to meet the scale section, and this part is composed of 1-in. × ⅛-in. steel strip, which started life as the framework of old baby-carriage hoods. The general appearance of the track can be judged from Fig. 7. The engine is a fine example of an L.N.E.R. "Pacific" by Mr. F. Wiswold, of Enfield, Middlesex.

Much could be written on the various aspects of garden railways, and it is hoped that the foregoing notes dealing only with the constructional side may be of interest to readers contemplating a layout.

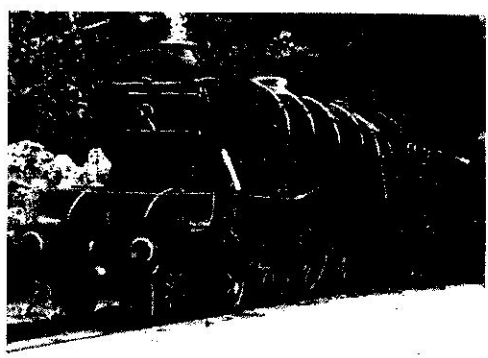


Fig. 7. An engine standing on "tramway type" track

Farewell to Pistons?

AT a recent London conference Lord Brabazon expressed the view that in three years' time I.C. engines with pistons would be obsolescent. The jet engine would hold the field. Sir Frederick Handley Page emphatically disagreed with this opinion and predicted that the piston-type of engine would be with us for a long time to come. Time alone will show which of these two experts is right, but, of course, it must be understood that the propulsion of 'planes was the point at issue. Jet propulsion by hydraulic motor has been successfully used in boats, and rocket-propelled cars have been tried on both road and rail. There is room for much experiment by enterprising model engineers, but for model speed boat work and rail and road traction the piston engine will take some beating. Jet propulsion on a small scale presents its own difficult problems, but possibly a Whittle will arise among model engineers and solve them.

Letters

Ciné Design

DEAR SIR,—I was interested in Mr. Knightbridge's letter published in your issue of June 20th. Whilst his idea of using a large sprocket geared to a four-point cross is very attractive and quite feasible in theory, I am afraid there would be quite a number of snags if it was put into practice. In the first place, the gears used would have to be cut with absolute exactness, as the slightest inequality would be glaringly shown up in the form of unsteadiness of the picture.

Secondly, the addition of a larger sprocket and its associated gear train, to be set in motion and stopped four times during each rotation of the cross, is going to add considerably to the wear and tear of that already hard-worked piece of mechanism, as also would any spring-loaded device to take up the backlash in the gears.

Thirdly, I think that the strain of the continual starting and stopping of the gear train, being necessarily borne by the same gear teeth every time, would quickly show itself in the form of unequal wear in the gears, again giving rise to unsteadiness of the picture.

I do not say such a device could not be made to work, but I do say that it would soon prove itself to be inferior in performance to either the Maltese-cross or the much-criticised, but perfectly efficient, claw movement.

Yours faithfully,

Sheffield. H. GERALD TOOTHILL.

A 4-in. Lathe and its Equipment

DEAR SIR,—I read with interest Mr. K. N. Harris's remarks, on page 535, in the second of the two articles under the above title, in connection with the method employed for bedding-in the cross-slide, which might be described as "duplex" bearing surfaces (Fig. 10 on page 534 of the same issue).

Only a week or so ago I was studying with interest (but without intention to purchase) a very fine bulletin describing the 12 in., 14 in. and 16 in. swing Toolroom Lathes built by the Lodge and Shipley Company, of Cincinatti, and noticed with interest that these people employed a similar construction to that since described by Mr. Harris, but for a different purpose, i.e. the bearing surfaces between carriage and bed. The bed is of the standard American inverted-vee style, the ways being "vee, flat, vee, vee," in that order, reading from front to rear across the bed.

However, whereas the conventional practice is to guide the carriage by the two outside vees only, leaving the inner vee and the flat way to take care of the tailstock, Messrs. Lodge and Shipley arrange matters so that a supplementary bearing for the carriage is taken from what normally would be the flat way for the tailstock. Additionally, the vertical surface of the flat way is finished, and provides a further bearing surface for the carriage which I should imagine would be particularly effective in resisting the strains encountered in heavy cutting, particularly of an intermittent nature. To quote the catalogue: "The carriage ways take a full length bearing on three separate surfaces of the bed, giving many years of positive alignment. The extra flat bearing reduces the span of the (carriage) bridge and greatly increases its strength."

I should say that any form of construction involving duplex slides calls for workmanship of the highest order, in which case it offers decided advantages. Otherwise, I should imagine it is best left alone.

Incidentally, reverting to lathe beds of the inverted vee type I notice that whilst a majority of makers, both English and American, favour the "vee, flat, vee, vee" arrangement mentioned above, quite a number use the "vee, flat, vee, flat" design, which, of course, gives only a single guide to the carriage in a horizontal plane.

Yours faithfully,

London, W.3. F. SEWARD.

Old Telegraph Instruments

DEAR SIR,—With reference to your note "Information Wanted" appearing in the issue of THE MODEL ENGINEER for May 30th, I possess a copy of "The Application of Physical Forces," by Amedée Guillemin, translated by Mrs. Norman Lockyer and edited by her husband, J. Norman Lockyer, F.R.S.

This book was published in 1877 and it contains a fairly full description of the Breguet signalling apparatus, running to about ten pages in all.

In addition to illustrations of the individual instruments, there is one of the complete outfit as set up in the telegraph office. From a comparison with your illustrations, the following points emerge:

(1) The wooden bases of the instruments are not identical with the original Breguet bases. These had rounded corners.

(2) The dials conform with those fitted to the earlier type of Breguet "Manipulator" and "Indicator," these being the names apparently given to the transmitter and receiver.

(3) On the originals there was a pair of switches, called commutators, to enable the operator to communicate with either one of two stations situated to right and left of him respectively. These switches do not appear in the instrument you illustrate.

(4) Your receiver bears no resemblance to the "Indicator" shown in my book, except in so far as the dial is concerned. The original Breguet instrument was enclosed in a rectangular wooden box and the terminals fitted were of a different type altogether, though those shown on your transmitter are correct.

(5) The original Breguet machines were clearly of larger dimensions than those given by you.

I think it is fairly safe to assume that we have here a *model* of the *earlier* type of Breguet apparatus which, so far as the "Indicator" was concerned, does not appear to have been fitted with a clock escapement, as were the later versions.

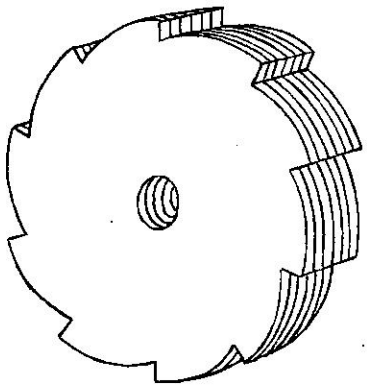
As to the change-over from "letters" to "figures," this was indicated to the recipient of the message by sending as a prefix the letter C twice. It is unfortunate that no mention is made of the way in which the reversion to letters was indicated, but, presumably, some combination of a pair of numbers must have been used.

Yours faithfully,

East Horsley. IAN BRADLEY.

An Armature Query

DEAR SIR,—I noticed recently that a partially dismantled motor-car windscreen-wiper motor had an armature, perhaps 2 in. in diameter, composed of about half-a-dozen laminations (presumably soft-iron plates), somewhat as shown by the sketch herewith.



Perhaps some of your more electrically-minded readers would be good enough to explain the action and correct shape of plates of such an armature, and also the extent of its possible useful application to model work—say for driving small locomotives or boats.

A detail drawing showing the construction of a complete motor with this type of armature, but without the reversing mechanism of a windscreen-wiper, would possibly be of interest to a number of your readers, especially if particulars of suitable field windings for low voltages could be afforded.

Yours faithfully,
Sheffield. J. W. HUSBAND.

A Pit Engine Model

DEAR SIR,—On opening the June 13th issue of THE MODEL ENGINEER I was very interested in the photographs of the pit engine by Mr. Howlett. I have examined this under a powerful glass and the valve mechanism is apparently of Watt's design, also the radial arm guide motion to the crosshead. I imagine it to be a model of some North Country colliery winding engine, judging by the position of the steam throttle-valve being on the top floor of engine so as to give the driver a full view of the pit top. In the original, no doubt the cylinder would be carried on strong wood beams supported on stone pillars with the radial arms attached to wall brackets, but in order to show the fullest details in the model the builder has substituted steel turned columns. It would be very interesting if anyone could throw more light on the history of the original, such as the place where it worked, the name of the pit, or the maker; also, if it was geared to the rope drum.

Yours faithfully,
Pinxton. FRED SMITH.

Clubs

Sunderland Model Boating and Engineering Club

The locomotive section's 3-in. gauge oval track in Roker Park is now complete, and we had a royal day on Saturday, June 8th, when Major F. W. Lawson put Mr. Hudson's 4-6-2 "Fayette" through its paces. Other locomotives were Mr. W. Graydon's 2-6-0 "Dyak," Mr. J. Murta's free-lance 4-4-2 "Atlantic," Dr. Spark's 0-6-0 "Mary Ann," and Mr. P. T. Atkinson's free-lance 2-6-2. Dr. Spark's 1-in. scale traction engine created a lot of amusement by pulling five adults round the disused tennis court inside the track. Among our visitors were Mr. Evans and Mr. Egdell, of the Tyneside Society. The track is open Saturdays (afternoons and evenings), when we shall welcome any visitors.

Hon. Secretary: J. L. HOLBROOK, 84, Side Cliff Road, Roker, Sunderland.

Scunthorpe Society of Model Engineers

A meeting open to all interested in the sailing of model boats, called by the Scunthorpe Society of Model Engineers, received good support.

Mr. S. S. Norman said the object of the meeting was to get together all who were interested in the sailing or building of model ships, and to ascertain the need of suitable sailing water in the town.

Mention was made of the Model Power Boat Association and the Model Yachting Association, which controlled and promoted regattas, competitions, etc., in various parts of the country, and also arranged international events. The meeting agreed that the provision in Scunthorpe of a lake with facilities for the sailing of model boats would create greater interest in ships, provide an outlet for craftsmanship in the building of models and would prove to be of general public interest.

During the discussion, lakes in various parts of the country were described by those who had actually sailed models on them. All the lakes mentioned were in public parks.

It was agreed that a large round pond gave the most suitable sailing conditions.

Messrs. Ritchie, Gregory and Bradshaw were appointed to enquire into the possibility of a lake being provided for in the layout of the proposed Central Park.

Hon. Secretary, S. W. NORMAN, 14, Gervase Street, Scunthorpe.

Kettering and District Model and Engineering Society

At our last meeting, held at the Boys' School, Stanford Road, on June 5th, some twenty-eight members were present. After the business side of the meeting had been completed, we had shown the film "Pluto." This had a considerable local interest, as it was made by Stewarts & Lloyds at their steel works at Corby, a few miles away. The projector used was made by one of the members, Mr. T. Philips. Patterns, castings, etc.,

were all made by him, and the machine will take 16 mm. and 9.5 mm. silent and talkie films.

The screening was first class. The meeting finished with the examination of a partly-finished locomotive chassis, crankshafts, cylinders, and a twin-cylinder, single-acting vertical steam engine.

Hon. Secretary: B. L. G. WILKES, 36, Paradise Lane, Kettering.

The Society of Model and Experimental Engineers

The last meeting before the Summer recess will be held at 39, Victoria Street, Westminster, S.W.1, on Saturday, July 13th, at 2.30 p.m. The talk on this occasion will be given by Mr. Edgar T. Westbury upon the subject of Rotary valves applied to model internal combustion engines.

The fixture list for the second half of the year is now being completed and members will receive copies of this in good time.

The new issue of the "Journal" should now be in the hands of all members. They will note therein a form to be completed by all who can assist the forthcoming MODEL ENGINEER Exhibition by offering their services as Stewards or by the loan of models. The Council appeal to all who can help in this way to complete and send in these forms at once. Please remember that the success of the Exhibition depends upon a good showing of models and adequate manning.

Secretary: J. J. PACEY, 69, Chandos Avenue, Whetstone, N.20.

Burnley and District Model Engineers Society

The next meeting will be held at The Church Institute, Manchester Road, Burnley, on Friday, July 12th, at 7.30 p.m.

A full account of the exhibition will be in the next announcement.

Joint Hon. Secretaries: A. BATEY, 36, Mosely Road, Burnley; and J. D. MEE, 2, Windsor Avenue, Church, Nr. Accrington.

South London Model Engineering Society

The exhibition of models staged by the Society at St. Laurances Church, Catford, on June 20th, 21st and 22nd, proved highly successful, over two hundred models being on show.

Mr. P. G. Johnston's traction engine did yeoman service, being under steam most of the time, and was driven by Mr. T. Rowland and Mr. A. Dunbar, giving rides to youngsters and adults, while the locomotives were kept fully engaged dealing with the crowds waiting their turn for a ride.

The Society were able to hand over a substantial sum towards the Church restoration fund.

On Sunday, July 21st, we are holding a special track day at Kings College Sports Ground, Dog Kennel Hill, East Dulwich, starting at 2 p.m., when it is hoped to stage several model locomotive trials.

Mr. J. C. Crebbin has put up a prize for the best locomotive performance on this day, and we extend a very hearty welcome to all clubs in London and outlying districts to come and visit us on that date, bringing locomotives if possible to compete in these trials.

The meeting for Sunday, July 28th, to be held at Kings College Sports Ground, at 11 a.m., will be ten minute talks by six members. Arrangements will also be made for the collection of models and final details arranged for the Society's stand at the MODEL ENGINEER Exhibition in August.

Hon. Secretary: W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Buxton Model Engineering Society

Eighteen enthusiasts met at Messrs. Collinson's Café recently to discuss proposals for the formation of a Model Engineering Society in Buxton. The idea was enthusiastically received and unanimously approved.

In his opening remarks, the Chairman, Mr. R. Hattersley, emphasised that the chief object of the Society was to further the exchange of views and opinions on matters relating to model engineering in all its branches, and called for tolerance on the part of all members. It is hoped to arrange visits to works and places of interest in the near future.

Particulars of membership can be obtained from either the Chairman, Mr. R. HATTERSLEY, "Granta," Lansdowne Road, Buxton; or the Secretary: L. M. HOBDEY, "Westward Ho!" Lightwood Road, Buxton.

Glasgow Society of Model Engineers

The society has removed to new rooms at 60, Clarendon Street, Glasgow, N.W., five minutes from St. George's Cross Underground Station. The usual Saturday evening opening will be observed until establishment allows for the reinstatement of pre-war opening arrangements. Meantime any willing to assist in the considerable rehabilitation scheme now in progress should advise the Secretary, so that the best use can be made of the generous offers so far received. There will be no official meetings in July or August, but opportunity will be taken of the respite to establish the new headquarters. It is hoped to publish the usual "Bulletin" in September, in which month, also, an effort is being made to open the 840 foot continuous railway site at Rutherglen. Here again, those interested in locomotive matters are invited to assist. The work is now approaching an attractive stage, namely, preparation for rail laying.

Visitors will be welcomed and particulars of membership can be had from the address below.

Secretary: JOHN W. SMITH, 785, Dumbarton Road, Glasgow, W.1.

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Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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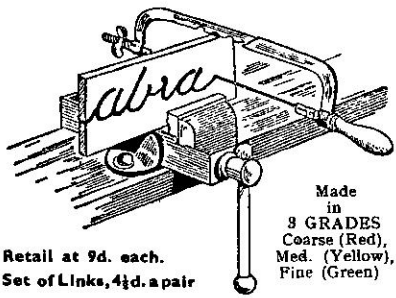

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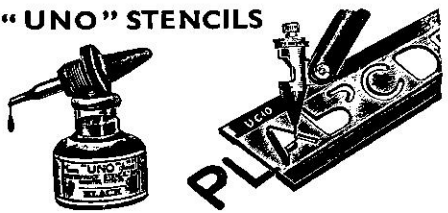

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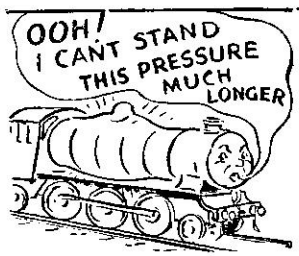

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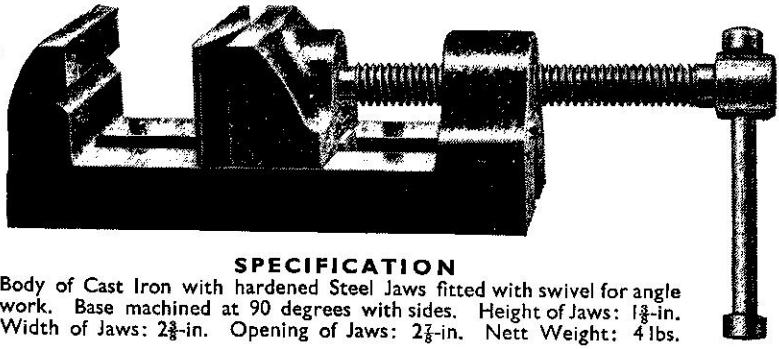

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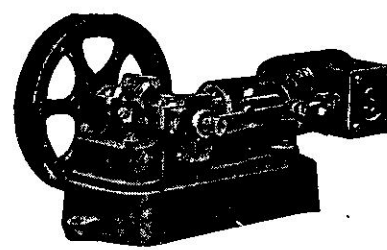

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